Chapter 3 -- SUMMARY OF AGENCY GROUNDWATER ACTIVITIES

DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources (DNR) has statutory authority as the central unit of state government to protect, maintain and improve the quality and management of the waters of the state, ground and surface, public and private (s. 281.11 Wis. Stats.). The DNR establishes the groundwater quality standards for the state under authority of ch. 160, Wis. Stats. DNR regulatory activities to protect groundwater are the responsibility of four programs:

Drinking Water and Groundwater (DG) – Regulates public water systems, private drinking water supply wells, well abandonment and high capacity wells. DG is responsible for adoption and implementation of groundwater standards contained in ch. NR 140, Wis. Adm. Code, and works closely with other programs and agencies to implement Chapter 160, Wis. Stats., including groundwater monitoring, database management, and staffing the Groundwater Coordinating Council. The new provisions under 2003 Wisconsin Act 310 are also being implemented by DG. The program also coordinates the state's Wellhead Protection and Source Water Protection programs.
http://dnr.wi.gov/org/water/dwg/index.htm

Waste and Materials Management (WMM) – Regulates and monitors groundwater at proposed, active, and inactive solid waste facilities and landfills. WMM reviews investigations of groundwater contamination and implementation of remedial actions at active solid waste facilities and landfills. WMM also maintains a Groundwater and Environmental Monitoring System (GEMS) database of groundwater quality data from over 600 solid waste facilities and landfills and uses reports from GEMS to evaluate whether sites are impacting groundwater quality. *http://dnr.wi.gov/org/aw/wm/index.htm*

Remediation and Redevelopment (RR) – Oversees response actions at spills, hazardous substance release sites, abandoned containers, drycleaners, brownfields (including the Site Assessment Grant program), "high priority" leaking underground storage tanks, closed wastewater and solid waste facilities, hazardous waste corrective action and generator closures, and sediment cleanup actions. A significant amount of the RR's work relates to groundwater contamination. *http://dnr.wi.gov/org/aw/rr/index.htm*

Watershed Management (WT) – Regulates the discharge of municipal and industrial wastewater, by-product solids and sludge disposal from wastewater treatment systems and wastewater land treatment/disposal systems. WT also issues permits for discharges associated with clean-up sites regulated by WT for the RR program. WT also has primary responsibility for regulating stormwater and agricultural runoff as well as managing waste from large animal feeding operations. *http://dnr.wi.gov/org/water/wm/index.htm*

The Department made significant strides in protecting groundwater in FY06

1. *Revised the Groundwater Study Guide materials* - Groundwater Section staff worked with other staff from the DNR, the Department of Public Instruction (DPI) and other agencies on revisions to the Groundwater Study Guide booklet and activity sheets. These are important components of the Groundwater Study Guide packet that the DNR has distributed to teachers for over 15 years. The revised booklet, activity sheets and new folders for the packet materials were published in early 2006, replacing 1990 versions.

The 2006 versions of these documents have been added to the DNR Environmental Education for Kids (EEK!) website (dnr.wi.gov/org/caer/ce/eek/teacher/groundwaterguide.htm) and the groundwater education website (dnr.wi.gov/org/water/dwg/gw/educate.htm).

2. *Provided Groundwater workshops for teachers* - For the sixth year in a row, DNR staff worked with the Wisconsin Geological and Natural History Survey and Center for Watershed Science and Education to sponsor three groundwater workshops for teachers in January 2005. Teachers from 21 school districts were given training in the use the groundwater sand tank model and given models to take back to their schools. The intent is to provide information for teachers to educate students – and their parents – on the importance of groundwater protection.

3. *Implemented the Groundwater Protection Act* – In May of 2004, the statutes regarding high capacity wells were expanded to give the DNR the authority to consider environmental impacts of wells in order to protect critical surface water resources. Other changes include notification and collection of fees for all new wells and requirements for reporting water use on an annual basis for all high capacity wells. Further provisions in the Groundwater Protection Act include designation of two Groundwater Management Areas to address regional groundwater issues and the creation of a Groundwater Advisory Committee to recommend management approaches in these areas and further statutory changes. In FY 06 DNR hired staff to implement the new law. Progress was made on the following components of the new law:
   - Implementation of an automated Internet well construction notification and fee collection system as well as an approval application tracking system.
   - Assessing the availability of data and evaluation tools needed for evaluating potential significant adverse impacts of high-capacity wells on sensitive surface waters.
   - Management and coordination of three research and monitoring projects on springs and one on small stream flow monitoring.
   - Staffed the first year of Groundwater Advisory Committee (GAC) and Subcommittee meetings. The GAC meetings occurred every two months.

4. *Implemented the Groundwater Monitoring Strategy* - In FY 06, DNR staff began implementation of the statewide groundwater monitoring strategy with representatives from the DATCP, USGS, WGNHS, and UW Stevens Point. The objective of the strategy is to coordinate groundwater monitoring between all state agencies that regulate groundwater to assess groundwater quality and quantity in the state. Over the next ten years, components of the strategy will be integrated into DNR's overall water monitoring plan.

5. *Approved 512 Cleanups of Contaminated Properties*- That number raised the total of approved cleanups (excluding spills and abandoned container responses) to more than 13,700. Program staff also:
   - helped 95 percent or more of the cleanups undertaken by responsible parties proceed without enforcement.
   - responded to nearly 100 requests for detailed, fee-based technical reviews.
   - worked with hundreds of inactive responsible parties resuming site investigation and cleanup activities.

6. *Provided Assistance Through Start-up Site Assessment Grants For Brownfields* - In FY 06, the RR Program awarded 50 Site Assessment Grants totaling approximately $1.7 million to 33 communities across the state. Small grants up to $30,000 make up 42 of the awards, while eight are large grants between $30,000 and $100,000. Local governments have also pledged more than $1.1 million in additional funds for the projects, well beyond the 20 percent match required through the application process.

   The grants will provide funds for environmental activities on 94 acres of land. Activities include 69 site assessments and investigations, the demolition of 50 buildings or structures and the removal of 120 tanks, drums and other abandoned containers. Since 2000, 307 grants have been awarded to 150 communities around the state for work on 944 acres of land.

7. *Helped Prevent and Control Toxic Spills* - The RR Program partnered with state and local emergency responders at more than 500 hazardous substance spills and provided outreach and education to facilities and responders statewide to help prevent spills.

8. *Provided State-Funded Response at Orphan Site* - When a responsible party is unknown, unable or unwilling to conduct environmental restoration, the RR Program protects human health and the environment with a state-funded cleanup. In 2006, the Program spent $3.5 million in Environmental Fund dollars to initiate or continue environmental cleanup actions at approximately 62 locations where groundwater contamination is known or suspected. The Program also recovered over $550,000 in state expenses that had been used to address contamination, where responsible parties would not proceed with investigation or cleanup.

9. *Initiated Work on Brownfield Grant for 30th St. Corridor Work in Milwaukee* – Capitalizing on $400,000 in grants obtained in FY 05 ,The DNR, in partnership with the city of Milwaukee and the 30th Street Industrial Corridor Corporation, selected a focus area as the priority location for conducting site assessments. Fourteen Phase I Environmental Site Assessment reports have been completed. Sampling has taken place on two properties for the completion of Phase II reports. The partnership participants are working with EPA and the Department of Health and Family Services to leverage additional studies and resources to encourage brownfields redevelopment.

10. *Provided Accessible and In-Depth Public Information* – Remediation and Redevelopment staff continued to improve one of the nation's most comprehensive web sites on environmental contamination, investigation, cleanup, liability, redevelopment and financial aid, averaging over 100,000 web hits per month. The RR Program also maintains records on thousands of active investigations and cleanups of contaminated properties in an Internet-accessible format. In addition, Program staff attended more than 100 meetings with local officials to provide assistance on cleanup and redevelopment of contaminated properties.

11. *Approved New Wellhead Protection Plans*. In FY 06, 11 communities received DNR approval of required WHP plans (for new wells) and 22 communities submitted voluntary plans to the DNR. In addition, WRWA completed Source Water Protection Plans for 3 geographic areas (with multiple public water systems) in FY 06. There are now nearly 300 communities who have a WHP plan for at least one of their wells.

More information about the groundwater programs and activities of the DNR is detailed in the following pages.

Drinking Water and Groundwater Program

Groundwater standards. Chapter 160, Wis. Stats., requires the DNR to develop numerical groundwater quality standards, consisting of enforcement standards and preventive action limits, for substances detected in, or having a reasonable probability of entering, the groundwater resources of the state. Chapter NR 140, Wis. Adm. Code, establishes these groundwater standards and creates a framework for their implementation. There are currently groundwater quality standards for 122 substances of public health concern, 8 substances of public welfare concern and 15 indicator parameter substances in ch. NR 140.

DG maintains a table listing NR 140 groundwater quality standards, NR 809 state drinking water standards, and established health advisory levels (HALs) for substances in water (*http://dnr.wi.gov/org/water/dwg/health/hal.htm*). This table of regulatory standards and advisory levels provides a useful source of information to members of the public concerned about the safety of their drinking water and also is a valuable resource for DNR staff involved with groundwater contamination and remediation cases. Links in this table allow users to obtain additional toxicological and health related information on many of the substances listed.

DG staff work closely with the RR program to identify policy issues, develop guidance, and provide training regarding the implementation of chs. NR 720, 722, 724 and 726 dealing with soil cleanup standards, selecting and implementing remedial actions, and case closures. DG staff also provide advice and assistance on site investigations, soil and groundwater remediation, and general case closure decisions. This coordination is critical in obtaining statewide consistency on how the DNR evaluates, addresses and closes soil and groundwater contamination sites.

DG staff work with Runoff Management staff to ensure that new performance standards for stormwater infiltration (NR 151) comply with groundwater standards specified in NR 140. DG participated on a team writing stormwater management guidance for developers, land use planners and government agencies to help assure that stormwater practices meet performance standards while preserving groundwater quality.

Revisions to NR 140 groundwater quality standards have been adopted by the Natural Resources Board. These revisions include revised NR 140 groundwater quality standards for butylate, dacthal and naphthalene, and new NR 140 groundwater quality standards for molybdenum and alachlor ethane sulfonic acid (alachlor-ESA), a breakdown product of the herbicide alachlor. The proposed revisions to NR 140 adopted by the Natural Resources Board are currently being reviewed by State Legislative Committees.

Groundwater Protection Act Implementation. The DNR is authorized under statute to regulate wells on each property where the combined capacity of all wells on the property, pumped or flowing, is greater than about 70 gallons per minute (100,000 gallons per day over a 30-day period). Such wells are defined as high capacity wells. Prior to 2004, when the operation of a high capacity well was anticipated to have an adverse impact on the quality or quantity of water available to a public utility well, the DNR was obligated to deny approval or to limit operation of the high capacity well so that their operation does not adversely impact a public utility well. In May of 2004, the statutes regarding high capacity wells were expanded through Wisconsin Act 310 to give the DNR the authority to consider environmental impacts of wells in order to protect

critical surface water resources. Specifically, the DNR is mandated to complete an environmental review under ch. NR 150, Wis. Adm. Code, for the following proposed high capacity wells:

- Wells located within 1,200 feet of an outstanding or exceptional resource water or a trout stream (i.e. Groundwater Protection Areas)
- Wells that may have a significant environmental impact on a high volume spring
- Wells where more than 95% of the water will be lost from the basin

In these cases, DNR may allow, deny or limit an approval to assure that these wells do not cause significant environmental impact.

Other statutory changes created by Act 310 include a new fee to be collected along with the application for approval and requirements for reporting water use on an annual basis for new and existing high capacity wells. Beginning May 1, 2005, the DNR required notification for all water supply wells prior to construction. A fee of $500 is required for all new high capacity wells and $50 for private wells.

In FY 06 the DNR hired five groundwater quantity staff to implement the new programs created by the law. Staff are handling workload associated with high-capacity well registration, fees, application review, data management, and inspections; and providing support to the Groundwater Advisory Committee (GAC), which has met every two months since April 2005.

The GAC has been addressing on a wide range of groundwater quantity issues and potential solutions including:

- Designation of Groundwater Management Areas and required water supply planning for water users in areas with water quantity problems;
- Data collection, research, and monitoring needed for evaluation of high-capacity well applications in Groundwater Protection Areas including tracking the progress of four springs projects.
- Other states' high capacity well application processes

Well construction and abandonment. DG sets and enforces minimum standards for well construction, pump installation and well abandonment through ch. NR 812, Wis. Adm. Code. The standards are intended not only to provide health protection but also to protect groundwater. DG also licenses and educates well drillers under ch. NR 146, Wis. Adm. Code, so that they are qualified to construct wells in a way that won't contaminate groundwater. Drillers submit reports to the DNR describing the construction of each well drilled. Field staff in the program conduct surveillance and inspections to enforce the minimum well construction standards.

Representatives of the Private Water Supply Program worked with the Wisconsin Water Well Association and members of the Wisconsin legislature to draft revisions to ch. 280, Wis. Stats. that should result in increased protection of groundwater (as well as increased public health protection.) The changes will go into effect in June, 2008. The significant changes include:

- Well abandonment must be performed by a licensed well driller or pump installer, or someone employed by a licensed well driller or pump installer—homeowners may not abandon their own wells. There is an exemption for wells under the authority of municipal abandonment ordinances.

- Well and pressure system inspections conducted as part of real estate transactions must be done by an individually-licensed well driller or pump installer (not an employee of a licensed person.) Inspection details will be specified in department rules and will require a diligent search for any wells that need to be abandoned.

- Drill rig operators must register with the department and will be required to complete additional training and/or testing requirements prior to becoming eligible to receive a well driller license. Each rig must have a licensed well driller or registered rig operator present onsite to supervise during all drilling activities.

- The department will have authority to issue citations for some violations that don't rise to the level of referral to the Department of Justice, e.g., work done without a license; work on substantially noncomplying existing pump installations (pits, short-cased wells); improper well abandonment; or repeated failure to collect water samples and/or submit well construction reports.

DG continues to promote electronic management of well construction and other information through its website at *http://dnr.wi.gov/org/water/dwg/gw/software.htm* and through semiannual releases of a Water Well Data CD.

The Private Water Supply program continued its surveillance, investigation, and referral of well drilling and pump installation violators to the Department of Justice for prosecution. Violations have included falsification of water samples, failing to grout, and short casing wells. Falsification of water samples involves collecting a water sample from a known safe source and claiming it was collected from the newly constructed well. Failure to grout or failure to properly grout is a threat to groundwater because the empty space around the well casing pipe provides an easy conduit for contamination to enter the groundwater and contaminate lower aquifers. Short casing well involves installing less than the code minimum amount of casing, and then reporting and billing for casing that was not installed.

Another activity involved the designation and enforcement of special well construction requirements in areas where arsenic is known to exist. These requirements, if not followed, could allow naturally occurring arsenic to enter groundwater at higher levels. The DNR has designated a special casing area that covers all of Outagamie and Winnebago Counties. In these areas wells must be constructed to avoid the arsenic rich St. Peter and Prairie du Chien formations. Wells can be constructed to draw water from the overlying Galena/Platteville dolomite or they must be cased and grouted into the Cambrian sandstone. The Department is working with the WGNHS to update and refine the geologic mapping and improve the accuracy of the special casing requirement depths.

Groundwater monitoring well requirements, as specified under NR 141, are administered by DG staff. Activities include consultation on well construction with Remediation and Redevelopment, Waste Management & Materials, Watershed Management and Department of Commerce staff, consultants and drillers. Random inspections of environmental drilling operations provide an opportunity for DNR hydrogeologists to update drillers and consultants about NR 141 requirements and enhance compliance with the code. Review of new technologies and their application also continue to be a priority.

Aquifer Storage & Recovery (ASR) pilot testing. Aquifer storage and recovery (ASR) is a water supply management technique involving the injection of water into an underground aquifer for storage and later recovery. The technique has been proposed in Wisconsin to address the problem of peak seasonal water supply demand. A water utility may not have the storage reservoir volume or water treatment plant capacity to provide enough water to users during summer high, "peak", water demand periods. Using ASR a utility might store "surplus water", water treated during periods of "low" demand, underground for later recovery during peak demand periods.

ASR has been proposed as a lower cost alternative to address peak seasonal water demand, than construction of additional "above ground" water storage structures, or upgrading to increase existing water treatment facility capacity.

Rules have been established by the DNR to regulate the use of ASR technology in Wisconsin. These regulations, in ch. NR 811, Wis. Adm. Code, limit use of ASR to municipal water systems and require that any water, placed underground for ASR storage, meet state drinking water (ch. 809, Wis. Adm. Code) and groundwater quality (ch. NR 140, Wis. Adm. Code) standards. Chapter NR 811 also requires that water recovered from ASR storage meet drinking water standards prior to being placed in a municipal water distribution system and that operation of an ASR system not cause exceedances of state NR 140 groundwater quality standards in the aquifer used for ASR water storage. Before "long term" operational approval of an ASR system is granted in Wisconsin, pilot testing of the system is required.

To date, two municipalities in Wisconsin, Oak Creek and Green Bay, have conducted ASR pilot tests. Both pilots have tested the viability of storing treated Lake Michigan surface water in the Ordovician - Cambrian carbonate/sandstone aquifer ("deep sandstone aquifer") system. Both tests were designed to inject and recover ASR water through a single test site ASR well, and both pilot tests have included monitoring to assess ASR impacts on ambient groundwater quality.

Both ASR pilot tests conducted to date have resulted in trace elements, from aquifer matrix material, being mobilized in groundwater to levels above state groundwater quality standards. This appears to have been caused by the injection of highly oxidized, "reactive" Lake Michigan surface water into the relatively reduced redox environment of the deep sandstone aquifer system. It also appears that some trihalomethane (THM) disinfection byproducts present in the disinfected Lake Michigan surface water, and also generated in the aquifer during ASR storage, are not degrading as readily as originally suggested. Because the proposed operation of the ASR systems pilot tested results in some of the stored ASR water remaining in the aquifer after each ASR pumpout cycle is completed, there is the potential for THM disinfection byproducts to accumulate over time in the aquifer used for ASR storage. The increasing accumulation of THM disinfection byproducts in an ASR storage zone over time is likely to result in exceedances of state groundwater quality standards for these substances at the ASR system compliance boundary.

Green Bay decided after the second smaller injection to abandon further plans to test ASR. Significant levels of arsenic and other contaminants were mobilized from aquifer bedrock during the Green Bay pilot test ASR storage periods. Additionally, the city’s need for increased water storage changed. Communities surrounding the city that initially considered purchasing drinking water from Green Bay decided to purchase their water from Manitowoc instead.

Pilot testing of ASR at Oak Creek has shown that the technology may be viable, although, manganese appears to have been mobilized from aquifer bedrock during the ASR pilot test and levels of this substance in groundwater have increased. Oak Creek has been issued a conditional approval to use ASR, as pilot tested, provided that geochemical monitoring indicates that mobilized substances do not exceed state groundwater quality enforcement standards.

Public water systems. DG oversees monitoring and operation of public water systems through ch. NR 809 (Safe Drinking Water), Wis. Adm. Code, to ensure all public water systems are safe to drink and use. Working in cooperation with owners and operators of water systems DG ensures that samples are collected and analyses completed to determine if the water meets federal Safe Drinking Water Act (SDWA) standards. Also, through ch. NR 811 (Requirements for the Operation and Design of Community Water Systems), DG regulates the general operation, design

and construction of community water systems. DG also works to educate water system owners and operators concerning proper operation and maintenance of water systems to ensure safe drinking water for Wisconsin consumers.

DG developed and continues to maintain data about Wisconsin's drinking water and groundwater quality through the Drinking Water System database. The Drinking Water System is an important tool used to efficiently enforce SDWA regulations for public water systems. It contains the monitoring and reporting requirements for each public water system and their drinking water sampling results. It also includes violations for any missing requirements and exceedances of the maximum contaminant levels (MCLs).

This fiscal year, DG has been working with private laboratories to allow electronic submission of data to continuously improve the process in which water quality sampling results are received. Additionally, DG has been working on implementing new federal rules and updates to existing rules dealing with arsenic and disinfection byproducts.

Wellhead protection. The DNR is the lead state agency for developing and implementing the Wisconsin Wellhead Protection (WHP) Program. The specific goal of Wisconsin's program is to achieve groundwater pollution prevention in public water supply wellhead areas (area contributing groundwater recharge to a well) consistent with the state's overall goal of groundwater protection. A WHP plan is required for new municipal wells and must be approved by the DNR before the new well can be used. A WHP plan is voluntary for any public water supply well approved prior to May 1, 1992; the DNR promotes and encourages but does not require wellhead protection planning for these older wells.

The DNR coordinates a statewide public information effort aimed at encouraging water utilities to protect their water supplies from potential sources of contamination through wellhead protection planning. Wellhead protection staff responded to over 30 requests for information during FY 06. Staff answered questions, sent publications, reviewed draft plans and ordinances and visited communities to assist in their WHP efforts. The DNR has prepared a video and several publications to assist communities in their wellhead protection efforts. The DNR also works with the Wisconsin Rural Water Association in providing assistance to local water utilities. Information is shared with local communities through a spring and fall wellhead protection newsletter. The DNR also maintains a web page (*http://dnr.wi.gov/org/water/dwg/gw/wellhead.htm*) with a variety of relevant information. In addition, the DNR has developed a tracking system for both wellhead protection activities in the DNR's Drinking Water System database. The DNR uses this information to report annually to EPA on WHP progress.

Other highlights include:

- *New wellhead protection plans*. In FY 06, 33 communities received DNR approval of required WHP plans (for new wells) or submitted voluntary plans to the DNR. (There were 11 communities with approved plans and 22 communities with voluntary plans.) In addition, WRWA completed Source Water Protection Plans for 3 geographic areas (with multiple public water systems) in FY 06. There are now nearly 300 communities who have a WHP plan for at least one of their wells.

- *Teacher training*. For the sixth year in a row, DNR staff worked with the Groundwater Center at the Center for Watershed Science and Education (CWSE) and the Wisconsin Geological and Natural History Survey (WGNHS) to sponsor three groundwater workshops for teachers

in January. Forty-two teachers from 21 schools took part in the workshops held in Madison, Green Bay and Spooner and were able to take a free groundwater model back to their school. Besides learning how to use the groundwater model, the teachers received groundwater resources to incorporate groundwater concepts into their classroom. The intent of the workshops is to provide information for teachers to educate students – and their parents – on the importance of protecting groundwater in their own communities. With funding from an EPA grant, 141 groundwater models have been given to schools since 2001.

- *Hosting meeting of EPA Region 5 states groundwater managers.* Wisconsin hosted the annual meeting of groundwater program managers for the EPA Region 5 states in September. Representatives from USEPA Headquarters and Region 5 joined managers from the 6 Region 5 states in Madison to talk about wellhead and source water protection and other issues of common interest.

- *CRP in wellhead protection areas*. The DNR worked with the federal Farm Service Agency to identify cropland in wellhead protection areas. Farmers that use cropland in wellhead protection areas could be eligible for cost-sharing and annual rental payments as part of the federal Conservation Reserve Program (CRP). The CRP program is designed to protect the environment by taking agricultural cropland out of production and installing conservation practices.

Groundwater Information and Education. In FY 06 DG staff, with help from other state agencies, revised three widely used groundwater publications. *Groundwater: Wisconsin's Buried Treasure***,** a popular DNR publication has been updated. The glossy 32-page color publication has a new look with updated photos and graphics. Information on Wisconsin aquifers, the water cycle and groundwater protection programs has been updated. New sections added include: How a well works, Groundwater quantity, and the Great Lakes Charter. To see the web version visit: *www.wnrmag.com/supps/2006/apr06/intro.htm*.

The *Groundwater Study Guide* booklet and activity sheets were recently revised and replace versions last updated in 1990. DNR, Department of Public Instruction (DPI) and other agency staff worked cooperatively on revisions to the Study Guide booklet and activity sheets, important components of the packet that the DNR has distributed to teachers for over 15 years. The booklet contains 13 groundwater exercises for students in grades 6-9 plus introductory information, a glossary, other groundwater activity ideas, groundwater education resource list and DPI Wisconsin Model Academic Standards; activity sheets correspond to the exercises. The 2006 version of these 2 documents has been added to the DNR Environmental Education for Kids (EEK!) website at http://dnr.wi.gov/org/caer/ce/eek/teacher/groundwaterguide.htm and the groundwater education website (http://dnr.wi.gov/org/water/dwg/gw/educate.htm).

Recently the arsenic standard for drinking water was officially lowered by the EPA from 50 µg/L to 10 µg/L. The *Arsenic in Drinking Water* brochure was updated to reflect the most current information and recommendations regarding arsenic in Wisconsin's groundwater. This will be helpful to those who seek reliable sources of information to help them understand whether their water supply is safe. The brochure is found at dnr.wi.gov/org/water/dwg/forms/arsenic.pdf.

Groundwater monitoring and research. Chapter 160 of the Wisconsin Statues requires the DNR to work with other agencies and the Groundwater Coordinating Council (GCC), to develop and operate a system for monitoring and sampling groundwater to determine whether harmful substances are present (s. 160.27, Wis. Stats.). The DNR has also supported groundwater monitoring studies evaluating existing design and/or management practices associated with

potential sources of groundwater contamination. The intent of these studies is to reduce the impacts of potential sources of contamination by changing the way land activities that may impact groundwater are conducted. See Chapter Two for more information on the DNR's monitoring studies .

During FY 06, $246,363 was spent on nine projects. Five new projects were selected for funding in FY 07. More details on the DNR's groundwater monitoring and research activities can be found at *http://dnr.wi.gov/org/water/dwg/gw/research.htm*.

Final reports received by the DNR in FY 06 include:

Bahr, J., Gittings Trethewey, H., 2005 Development of a groundwater flow model for the Mukwonago River watershed, southeastern Wisconsin

Bradbury, K., Bahr, J.M., and Wilcox, J.D. 2005 Monitoring and predictive modeling of subdivision impacts on groundwater in Wisconsin

Final reports and 2-page research summaries are available for most projects from the Water Resources Institute website: *http://wri.wisc.edu/wgrmp/wgrmp.htm*.

In FY 06, DG staff worked with representatives from the DATCP, USGS, WGNHS, and UW Stevens Point on refining and implementing a new statewide groundwater monitoring strategy. The objective of the strategy is to coordinate groundwater monitoring between all agencies that assess groundwater quality and quantity in the state. The statewide groundwater monitoring strategy will help DNR meet the prerequisites of the Clean Water Act Section 106(e)(1) as described in the EPA's "Elements of a State Water Monitoring and Assessment Programs" guidance document. Specific goals include:

- Documenting status and trends in groundwater quality, quantity and use;
- Improving of understanding of groundwater systems and groundwater/surface water interactions; and
- Communicating groundwater information to citizens, policy makers and resource managers.

Over the next ten years, components of the strategy will be integrated into DNR's overall water monitoring plan. Other agencies will also continue to make improvements in their monitoring efforts based on the comprehensive strategy. The components of the strategy may change over time according to needs of the different agencies. The requirements of Chapter 160, Wis. Stats., will continue to be met under the strategy.

Groundwater data management. Groundwater data from the DNR's consolidated Groundwater Retrieval Network (GRN) system is available on the following website: *http://dnr.wi.gov/org/water/dwg/data.htm*. GRN accesses groundwater data from three database systems in the Waste Management and Drinking Water and Groundwater programs including information on approximately 300,000 wells. These wells represent public and private water supply wells, piezometers, monitoring wells, non-potable wells, and groundwater extraction wells. In FY 06, DG staff continued to improve the locational data associated with GRN's wells.

The DNR continued to make progress on several other groundwater-related data initiatives in FY 06. DG continued to improve its public water supply well data and coordinated efforts with the RR, WMM, and WT programs to improve the DNR's data on significant potential sources of contamination that may threaten these wells. Additionally the WGNHS and DNR continue to

improve their searchable index of scanned images of more than 350,000 well construction reports (see WGNHS section) for SWAP and other program uses. Work continued to refine and update the Source Water Assessment Mapping Application which is a Geographic Information System that maps locations of public wells, their source water areas, and potential contaminant sources in a format consistent with vulnerability assessment program, WHP, and other DNR needs. Another application, the Assessment Form, uses the mapped potential contaminant sources along with well construction, monitoring, and geologic information to help DNR staff determine susceptibility of public wells to contamination. These applications are at the leading edge of DNR's efforts in integrating spatial and tabular data toward the goal of public health protection.

Waste and Materials Management Program

The Bureau of Waste and Materials Management (WMM) implements the DNR's Groundwater Standards Program in several ways during the life of a landfill. Whenever staff review an applicant's "Feasibility Report," which proposes to site a landfill in a particular location, they review baseline data submitted by the applicant to determine whether exemptions and alternative concentration limits are needed for the public health and welfare parameters listed under NR 140. In addition, the reviewers establish preventive action limits for indicator parameters based on calculations submitted by the applicant. During the active life of a landfill and after closure, staff evaluate groundwater conditions at the landfill site to determine compliance with NR 140 Standards. Should conditions warrant, staff require groundwater investigation reports that include proposals for further evaluations and recommendations for remediation at landfills that exceed groundwater standards. Staff review results of site investigations triggered by the exceedances of groundwater standards and evaluate the effectiveness of remedial actions at active solid waste facilities and at closed landfills by comparing results to groundwater standards over time.

WMM only accepts electronic submittal (via diskette or CD) of environmental monitoring data from landfill owners, labs and consultants. As of January 2006, WMM provides facilities and the public access to the environmental monitoring data contained in its Groundwater and Environmental Monitoring System (GEMS) database. In the future, we hope to provide a web interface, possibly using the Department's Data Portal and/or Web Access Management System, to allow facilities to upload environmental monitoring data into GEMS, if funding is available to do the necessary programming.

WMM has been concerned that staff might not be aware of some old, closed landfills that may be impacting groundwater. Program staff used several reports from the Groundwater and Environmental Monitoring System to do a rough screening of old, closed town, city and village landfills with monitoring wells. In July 2003 we sent the screening reports, identifying landfills that need further attention to each of the regions for follow-up evaluations. Program staff have since reviewed most of the identified sites. A more in depth screening of all closed landfills is planned by the end of 2006.

Between July 2000 and July 2001 WMM studied 31 landfills that accept municipal solid waste, to try to determine whether VOC contamination in groundwater at these landfills is increasing, decreasing or remaining stable. We chose sites with 10 years of data and summarized the trends over this period of time. One purpose of this study was to determine whether natural attenuation is occurring in groundwater near leaking landfills. The study showed that natural attenuation processes were occurring at most of the landfills as evidenced by the large number of stable or decreasing concentration trends. However, the concentrations took longer to stabilize and stabilized at higher levels than at other types of VOC contamination sites described in the literature.

WMM and the UW Stevens Point received funding from July 1999 to July 2001 to evaluate the effectiveness of chemical oxygen demand (COD) as an indicator parameter at landfills. One reason for evaluating COD is that mercury waste is generated when COD is analyzed in the laboratory. The DNR's overall goal is to reduce the amount of mercury that gets into the environment so eliminating COD sampling at the 400+ landfills that currently sample for it would help us meet that goal. Findings from the first year of the study indicated that there was potential to eliminate COD monitoring at some types of landfills. The second year of the study evaluated possible alternatives to sampling for COD. Dissolved organic carbon (DOC) appears to be an acceptable alternative in certain circumstances. WMM staff have incorporated the recommendations of this study into code changes that went into effect in February 2006.

WMM received funding for the period October 2002 to October 2003 to study groundwater quality at solid waste landfills to determine whether they are a source of pesticide contamination. We sampled 11 sites the spring and summer of 2003 and summarized the findings in a 2005 GEMS Newsletter article. Groundwater samples were analyzed for 14 common Wisconsin pesticides using immunoassays and additional GC/MS methods. Preliminary findings indicated that leaking landfills may be contributing alachlor, aldicarb, atrazine and 2,4-D to groundwater. The study researchers believed a follow-up study was needed to provide more evidence to help make concrete recommendations about which pesticides to sample for. However, staff and funding are not currently available for this.

Remediation and Redevelopment Program

The Bureau for Remediation and Redevelopment (RR) has primary responsibility for implementing and aiding cleanups under the Spill Law, the Environmental Repair Law, federal programs (Superfund, Hazardous Waste Corrective Action, Leaking Underground Storage Tanks(LUST), Brownfields), the Land Recycling Law and State Brownfield Initiatives, the Drycleaner Environmental Response Fund and at closed landfills. The RR program provides technical assistance, helps to clarify legal liability, provides financial assistance primarily to local governmental units and provides technical project oversight of cleanup projects.

All cleanups are conducted according to the NR 700 rule series, Wis. Adm. Code, Investigation and Remediation of Environmental Contamination, and NR 140, Groundwater Quality. The majority of cleanups are done by persons responsible under the laws, or persons or groups involved in the redevelopment of potentially contaminated properties. Program staff provide technical assistance on cleanups conducted by consultants at the direction of responsible parties. In addition, RR staff contract and direct consultants on state-funded cleanups.

Cleanup of groundwater contamination. The program used $5.7 million in Environmental Fund dollars to initiate or continue environmental cleanup actions at over 60 locations where groundwater contamination is known or suspected. The Environmental Fund is used when contamination is significant but private parties do not undertake the cleanup because no one has legal responsibility for the contamination, the person(s) legally responsible do not have the financial ability to proceed, or the responsible person simply refuses to proceed. Private contractors conduct these cleanups with oversight by DNR staff. The program spends an average of over $5 million per year from the fund to address contamination at new and continuing project sites. Whenever feasible, the RR program and legal staff attempt to recover costs from responsible persons after the cleanups are undertaken.

Investigation, cleanup and redevelopment of brownfields. Brownfields are abandoned, idle or underused industrial or commercial facilities or sites whose expansion or development is adversely affected by actual or perceived environmental contamination. The RR program coordinates several efforts to encourage local governments and private businesses to cleanup and redevelop brownfield properties. At many brownfields sites, the release of hazardous substances threaten groundwater quality.

One of the financial assistance programs implemented by the DNR is the Brownfields Site Assessment Grant (SAG) program. The SAG program benefits groundwater by serving as a funding source for (1) the removal of potential sources of groundwater contamination, and (2) site investigations to determine whether groundwater and soil are contaminated, including the determination of the extent and degree of contamination.

This program provides grants to local governmental units to conduct environmental site assessments and other eligible activities at contaminated properties. Eligible activities include site assessment and investigation, demolition, asbestos abatement, removal of petroleum and hazardous substance storage tanks and removal of abandoned containers. Although the SAG program does not fund remediation activities, it funds preliminary activities to determine whether remediation is necessary. Sites are eligible for funding only if the persons responsible for the contamination are unknown, cannot be located, or cannot pay for the activities for which grant funding is requested.

In FY 06, DNR awarded 50 Site Assessment Grants totaling approximately $1.7 million to 33 communities across the state. Small grants up to $30,000 make up 42 of the awards, while eight are large grants between $30,000 and $100,000. Local governments have also pledged more than $1.1 million in additional funds for the projects, well beyond the 20 percent match required through the application process.

The grants will provide funds for environmental activities on 94 acres of land. Activities include 69 site assessments and investigations, the demolition of 50 buildings or structures and the removal of 120 tanks, drums and other abandoned containers. Since 2000, 307 grants have been awarded to 150 communities around the state for work on 944 acres of land.

The RR program also provides redevelopment assistance at brownfield sites with groundwater contamination. Program staff assist local governments and private businesses with the cleanup and redevelopment of brownfields by providing technical assistance. In many cases, these properties have groundwater contamination, or soil contamination that poses a threat to groundwater.

The RR program also provides a number of different assurance, comfort or general liability clarification letters related to properties with groundwater contamination. Collectively, these letters facilitate the reuse and development of properties. The RR program provided 103 redevelopment assistant reviews – which can include liability clarification letters, off-site exemption letters, cleanup agreements for tax delinquent properties, etc. – at brownfield properties throughout the state in FY 06.

The RR program also continues to provide technical assistance and assist parties with voluntary investigations and cleanups of Brownfield properties through the Voluntary Party Liability Exemption (VPLE) process. Many sites that follow the VPLE process have contaminated groundwater.

After a person has conducted an environmental investigation of the property, and cleaned up soil and groundwater contamination, the DNR will issue a "Certificate of Completion" which provides a release from future liability for any contamination that occurred on the property prior to issuance of the certificate. In FY 06, DNR issued a Certificate of Completion at nine properties for completed cleanups and 13 new sites began the voluntary cleanup process.

Drycleaner Environmental Response Fund (DERF) Program. The DERF program reimburses drycleaner owners and operators for eligible costs associated with the cleanup of soil and groundwater at sites contaminated by dry-cleaning solvents. Fees paid by the dry-cleaning industry provide program funding. Environmental cleanups at dry cleaner sites are conducted following the NR 700 rule series. To date, there are more than 130 sites in the program, at various stages of investigation and cleanup. The program is implemented through ch. NR 169, Wis. Adm. Code.

Site closure rules for petroleum contaminated sites. Under the Petroleum Environmental Cleanup Fund Award (PECFA) Program, NR 746 – and its Department of Commerce counterpart, Comm 46 – was promulgated in February 2001. The bulk of NR 746 establishes risk and closure criteria to determine whether petroleum contaminated sites can be closed using natural attenuation as a final remedy for groundwater contamination. The rule also defines which petroleum-contaminated sites DNR and Department of Commerce have authority to administer; summarizes site investigation requirements, and delineates other administrative requirements such as when remediation and remediation funding is terminated, tracking and transfer of sites, staff training and dispute resolution.

The rule provides that sites with contamination in low permeability (clay) materials can close after a site investigation if all risk criteria are met and the groundwater contamination is stable or receding. For contamination in permeable materials, sites must meet all risk criteria and demonstrate through monitoring that groundwater contaminants are declining. Sites requesting closure with groundwater contamination above NR 140 enforcement standards are placed on the GIS Registry of Closed Remediation Sites.

NR 726 provides closure requirements for all other sites.

Tracking System and GIS Applications. The program's main database on the status of sites undergoing investigation and/or cleanup is the Bureau of Remediation and Redevelopment Tracking System (BRRTS). In 2000, the program created *BRRTS on the Web*, making the DNR's main database for contaminated properties accessible via the Internet at *http://dnr.wi.gov/org/aw/rr/brrts/index.htm*.

In 2001, revisions to NR 726, 716, 749, and 811/812 implemented a Geographic Information System (GIS) Registry of Closed Remediation Sites to replace the requirement to record groundwater use restrictions at the County Register of Deeds Office. In 2002, additional rule revisions required the inclusion of sites with residual soil contamination on the GIS Registry. The GIS Registry currently includes locational information on sites closed with residual groundwater contamination above the NR 140 enforcement standards and sites closed with soil contamination above NR 720 soil standards, as well as site specific information pertaining to where the contamination is on the property in question and at what concentration it was found at the time the closure decision was made. In 2006, new legislation in WI Act 418 replaced the use of deed restrictions for certain sites with residual soil contamination with conditions of closure and placement on the GIS Registry.

Inclusion on the GIS Registry on the Internet provides a means of notifying future owners or users of the property of the existence of soil and/or groundwater contamination, as well as any responsibilities of the property owner (or occupant in some cases) to comply with any conditions of closure. The site specific information is attached to each site by a link to a .pdf. The GIS Registry can be accessed on the Internet at *http://dnr.wi.gov/org/aw/rr/gis/index.htm*.

The GIS Registry is to be used with well construction requirements for private wells, and with a setback distance for new municipal wells. Beginning in July 2004, the DNR made the GIS Registry information available to well drillers through a Well Construction CD that is updated twice a year. Before drilling, well drillers are asked to consult the CD to determine if a well is proposed for a property listed on the Registry. If the proposed well is located on a closed remediation site, then the driller must contact regional Drinking Water and Groundwater staff prior to any well construction activities to determine if additional casing or other construction techniques may be required.

In 2005, an additional GIS application was made available, called the RR Sites Map. This application shows the locations of the majority of sites available on BRRTS (open and closed), or provides an address for those sites for which geolocational coordinates have not yet been obtained. The RR Sites Map can also be accessed on the Internet at *http://dnr.wi.gov/org/aw/rr/gis/index.htm*.

The GIS applications are linked to *BRRTS on the Web* and are all useful for locating potential contamination sites when evaluating new municipal well placement or for property transactions. These databases make site specific information on open and closed remediation sites much more available and accessible to the public and specific interested groups, particularly those wanting to install or replace a potable well on an affected property, as well as those buying properties. Sites regulated by the Departments of Commerce and Agriculture, Trade and Consumer Protection are also included in *BRRTS on the Web, the GIS Registry and RR Sites Map.*

The RR Program continues to make improvements to both BRRTS and the GIS applications. The existing GIS applications are intended to be converted to ESRI's software product, ARCIMS, so that the programming and other maintenance tasks can be accomplished more quickly and at a lower cost. In addition to the ongoing efforts, work continues on quality assurance and quality control (QA/QC) of existing data.

Watershed Management

The Bureau of Watershed Management (WT) is responsible for statewide implementation of DNR's groundwater standards primarily through the issuance of discharge permits to facilities, operations and activities that discharge treated wastewater and residuals to groundwater. Field staff that work on integrated basin teams carry out compliance and enforcement activities using policies, codes and guidelines developed by the WT program. Integrated basin planning carried out in the field under guidelines developed by WT assess and evaluate groundwater (and surface water) and provide general and specific recommendations for the protection and enhancement of the basin's groundwater.

Wastewater discharges. WT issues Wisconsin Pollutant Discharge Elimination System (WPDES) permits to all communities, industrial facilities, and large privately owned wastewater systems which discharge treated domestic or industrial wastewater to groundwater through land treatment/disposal systems. These systems are primarily spray irrigation, seepage cell, subsurface absorption systems, and ridge & furrow treatment systems. WPDES permits issued to these

facilities contain groundwater monitoring and data submittal requirements that are used to evaluate facility compliance with ch. NR 140, Wis. Adm. Code, groundwater quality standards. Groundwater monitoring systems at existing facilities are evaluated and upgraded as necessary at permit re-issuance.

WT maintains a database, designated the System for Wastewater Applications, Monitoring, and Permits (SWAMP), for holders of specific WPDES and general permits. This database system stores facility specific information such as address, contacts, location, permit requirements, monitoring results, and violations of permit requirements for private and municipal wastewater treatment facilities. The system contains current information on groundwater, wastewater, and biosolids treatment/management. Historical sampling data from groundwater monitoring wells is available through the system and current sample results are added on a monthly basis. Sampling results and site loading information are also available for land application of municipal biosolids, septage and industrial sludge, by-product solids and wastewater.

WT continues to assist unsewered communities, served by failing or inadequate individual on-site treatment systems in their efforts to construct centralized wastewater treatment facilities.

In 2000, the Department of Commerce and DNR completed revision of an interagency memorandum of understanding after Commerce issued rules for private onsite wastewater treatment systems under ch. Comm 83, Wis. Adm. Code. The DNR completed refined procedures, guidance, and rules for the review and permitting of large private onsite wastewater treatment systems (POWTS). In general, large POWTS are defined as those with a capacity of greater than 12,000 gallons per day (gpd). The DNR started issuing permits to large POWTS in early 2000. On February 1, 2005 WT issued a general permit to regulate the operation of these types of systems in a more streamlined manner.

Septage and sludge management. WT implements the regulations in chapters NR 113, NR 204 and NR 214, Wis. Adm. Code. NR 113 relates to septage management and NR 204 governs the treatment quality, use, and disposition of municipal wastewater treatment plant sludge. NR 113 and NR 204 incorporate federal septage and sludge standards. WT regulates the land application of industrial sludge, liquid wastes and by-product solids through NR 214. Chapters NR 113, NR 204 and NR 214 contain treatment quality standards and land application site requirements and restrictions that are designed to prevent runoff to surface water or leaching of nutrients and pollutants to groundwater.

WT continues to implement a new statewide computer system that records and monitors treatment and disposal of municipal sludge, septage, and industrial land applied wastes. This system includes an inventory and a history of all sites used for land application. Wisconsin became the fourth state delegated authority by EPA to implement municipal sludge regulations, through its delegated NPDES (WPDES) permit program, in July of 2000.

Wisconsin Act 347 became effective April 29, 2006 and provides incentives for more wastewater treatment plants to accept and treat septage. This is accomplished through the offer of a zero percent Clean Water Fund loan for the planning, construction of receiving facilities, and additional capacity provided for septage. Facilities whom are upgrading capacity by more than 20% must evaluate septage generation and available disposal options in their planning area during facility planning. Although they are not mandated to provide such capacity they are offered the zero percent loan if they do so. Structures are provided by which Publicly Owned Treatment Works establish costs for receipt of septage and a process is laid out for dispute resolution when such costs are questioned. Land application also remains a viable option when appropriate and

the Act provides explicit pre-emptive authority to the state by disallowing restrictive local ordinances if they are not identical to state regulations.

Agricultural runoff. Chapter NR 243 Wis. Adm. Code covers the permitting requirements for livestock operations and currently contains provisions to protect surface water and groundwater in Wisconsin. DNR has proposed changes to ch. NR 243, Wis. Adm. Code to address revisions to federal rules that govern the operation and permitting of large concentrated animal feeding operations (CAFO) that were promulgated in April 2003. The proposed revisions to NR 243 improve groundwater protection from CAFOs by increasing setback requirements from community and non-community wells and karst features; and further restrict winter application of manure in areas with shallow soils over bedrock and groundwater. The Natural Resources Board adopted the proposed revisions to NR 243 in May 2005 and the rules are now before the state legislature for review. The rules are expected to be finalized in fall of 2006.

Under this existing rule, there are currently 146 WPDES permits issued for livestock operations (85% dairy; 8% poultry; 7% swine & beef). In addition, there are 5 large-scale livestock operations seeking permits for the first time. Regional and central office staff have successfully maintained the permit backlog at less than 15%. The trend of growing numbers of permit applications for operations with 1,000 or more animal units is expected to continue. In early 2005, a number of livestock operations (some not regulated as larger systems) had discharges that adversely impacted surface water and non-community wells. DNR investigated these incidents, initiated enforcement actions, and is evaluated the effectiveness of programs and procedures that are designed to protect water resources. The proposed revisions to NR 243 (see above) contain elements that are intended to help avoid discharges from permitted operations seen in 2005.

Storm water. Final revisions to Chapter NR 216, Wis. Adm. Code were promulgated on August 1, 2004. The revisions were completed primarily to comply with federal storm water regulations that took effect on March 10, 2003. The revisions to NR 243 requires nearly 200 municipal separate storm sewer systems to obtain permit coverage and also requires construction sites down to one acre of land disturbance to have permit coverage to control erosion during construction. Permit holders will also are required to install post-construction practices to limit pollutant discharge after construction is completed (storm water management). The DNR has developed performance standards (i.e. 80% sediment control, infiltration, peak flow, buffer requirements, etc.) that became effective in 2002. Many of these standards will be implemented through storm water permits, especially for new development.

Nutrient management plans: One of the performance standards included as part of the Nonpoint Redesign Initiative was a nutrient management standard, NRCS Standard 590. Under the rules, the performance standard itself became effective January 1, 2005 for high priority areas in the State (source water areas, impaired waters and outstanding/exceptional resource waters). The standard will become effective for the remainder of the state in 2008. On an ongoing basis, federal, state and local agencies are working to build the necessary resources and expertise to implement NRCS Standard 590. As an example, the Department of Agriculture, Trade and Consumer Protection (DATCP) cooperatively revised the technical standard to achieve DNR's performance standards. Although the implementation of the performance standards is limited by the amount of cost share that is available to participants, NRCS has provided extensive support of nutrient standards implementation through the EQIP cost share program.

For more information, visit the following website (http://dnr.wi.gov/) or contact Todd Ambs at 608-264-6278 (Todd.Ambs@dnr.state.wi.us) or Mike Lemcke at 608-266-2104 (Michael.Lemcke@dnr.state.wi.us), DNR, P O Box 7921, Madison, WI 53707-7921.

DEPARTMENT OF AGRICULTURE, TRADE AND CONSUMER PROTECTION

Protecting Wisconsin's groundwater is a priority for the Department of Agriculture, Trade and Consumer Protection (DATCP). DATCP's major activities in this area include management of pesticides and nutrients, research, and funding of local soil and water resource management projects.

In compliance with the Wisconsin Groundwater Law (1983 Wisconsin Act 410), DATCP manages pesticides and pesticide practices to assure that established groundwater standards for contaminants are not exceeded. This may include prohibition of certain activities including pesticide use. The agency also manages practices to "minimize" groundwater contamination to the extent "technically and economically feasible." DATCP regulates storage, handling, use, and disposal of pesticides, and the storage of bulk quantities of fertilizer. DATCP has authority to develop a statewide nutrient management program through section 92.05 Wis. Stats. The program includes compliance, outreach, and incentive components.

Enforcement standards have been established in Wisconsin for many known and potential groundwater contaminants, including over 30 pesticides. Standards for additional pesticides have been proposed. DATCP applies these standards and the Groundwater Law when addressing nonpoint and point sources of pesticide contamination in groundwater.

Nonpoint Source Activities

Pesticides. DATCP's primary effort related to nonpoint contamination (i.e., due to general use) of groundwater from pesticides continues to involve the herbicide atrazine. In response to concerns about atrazine contamination, DATCP amended administrative rule ch. ATCP 30 in 1992 to manage the use of atrazine in an effort to reduce or eliminate the potential for further groundwater impacts. Rule revisions have been made annually in response to additional detections of atrazine in groundwater. A set of 102 maps of new or existing prohibition areas is available from the Environmental Quality Section covering 1.2 million acres that have been incorporated into the rule. Information suggests that atrazine use has declined from peak levels in the late 1980's and is now holding roughly constant. The decline in use may have been a result of the atrazine management rule and concern about groundwater contamination.

Nutrients. DATCP, through its land and water resource management program, provides funding primarily to counties to assist in the protection of water resources through farmer adoption of nutrient management planning. A portion of this funding is dedicated to the development and implementation of improved nutrient and pesticide management practices. In FY 06 approximately $90,000 was provided to develop tools for nutrient management plans on farms to maximize profitability and to minimize excessive runoff of nutrients to surface and groundwater. $520,000 was budgeted and allocated in FY 06 to provide cost-sharing to write nutrient management plans. In 2005 the total reported acres with nutrient management plans was 772,661 acres. Additionally, staff worked to train farmers, consultants, and local agencies on the principles of sound nutrient management and how to comply with performance standards.

Point Source Activities

Previous work by DATCP identified pesticide and fertilizer operations as possible point sources of groundwater contamination. Past problems included improper disposal of unwanted agricultural chemicals, lack of containment for spills, out-dated product handling methods, and poor understanding by workers in the industry of how small actions when continued over time

lead to large problems. DATCP has worked to address these problems through point source prevention. In cases where environmental degradation has already occurred, DATCP oversees environmental cleanup of contaminated soil and groundwater.

Point source prevention for agrichemicals includes Agricultural Clean Sweep, enforcement of product containment rules and handling regulations, and education beyond the rule requirements through the Environmental Partners program. Point source cleanup activities are performed under the Agricultural Chemical Cleanup Program (ACCP), which provides technical oversight and reimbursement to offset much of the costs for investigation and cleanup.

Since 1990, the Agricultural Clean Sweep program has helped farmers dispose of unwanted pesticides, farm chemicals, and empty pesticide containers. Beginning in 1996, the program extended collection services to small agricultural businesses. In 2004 DATCP began operating and managing the state's household hazardous waste program. Approximately $731,500 was made available during 2005 for both agricultural and household programs and more than 600,000 pounds of waste were collected.

DATCP's rules for minimizing environmental damage from agrichemical storage and handling were put in place in 1988. Fourteen local DATCP specialists work with facilities across the state to keep them in compliance with the ATCP rules designed to protect the environment. DATCP staff also educate facility managers and employees about how routine practices may affect the environment.

The Environmental Partners program works to reduce the amount of agrichemicals that escape into the environment. 2005 was the fifth year for this program. Participation in the program is voluntary with the agrichemical industry and Department working together to identify the problems and brainstorm ideas to reduce pollution. The ideas used to solve problems at each facility are shared so that everyone can learn and benefit from the program.

In August 1993, section 94.73 of the Wis. Stats. was created and established the Agricultural Chemical Cleanup Program (ACCP) to address point sources of contamination. The ACCP reimburses responsible parties for cleanup costs related to pesticide and fertilizer contamination at facilities and in nearby wells. The program may also handle point source contamination on farms. To date, more than 390 cases involving soil and/or groundwater remediation related to spills, misuse, and improper storage or mixing and loading have been initiated at pesticide and fertilizer facilities and on farms.

The ACCP also funds DATCP oversight of pesticide and fertilizer cleanup activities. Program staff respond to and investigate pesticide and fertilizer contaminated sites throughout the state. Investigations at these sites are prioritized based on suspected contamination levels, with the higher levels investigated first. Investigations include discussions with facility staff or farmers to determine the most likely locations of contamination at the site. Other oversight activities include, but are not limited to, sample collection, laboratory analysis, and financial auditing.

Groundwater Sampling Surveys

DATCP conducts a number of annual surveys to investigate the occurrence of pesticides in groundwater resulting from nonpoint sources. Results of these surveys are provided in the "Pesticides" section under *Condition of the Resource - Groundwater Quality*.

Research Funding

Pesticide Research - Due to budget constraints, DATCP did not have funding for new pesticide research projects in FY06.

Nutrient Research - DATCP funds fertilizer research at approximately $130,000 per year.

Groundwater Data Management

DATCP maintains two groundwater sample databases: the Drinking Water Well System and the Monitoring Well System. The Drinking Water Well System contains contact and location information, well characteristics, and pesticide and nitrate sample results for private and public drinking water wells. The Monitoring Well System contains similar information for monitoring wells, and also tracks specific pesticide use history, soils, crop history, well construction, and precipitation and irrigation at monitored sites. These data represent samples analyzed by DATCP, Wisconsin State Lab of Hygiene (WSLH), and other public and private laboratories. DATCP's Drinking Water Well System currently contains information for over 38,000 wells and nearly 240,000 pesticide and nitrate-N results.

DATCP uses geographic information system (GIS) tools to analyze groundwater data and prepare maps for public hearings, DATCP board meetings, presentations, and other uses. DATCP prepares and maintains ArcInfo and ArcView data layers of well locations, atrazine concentrations, atrazine prohibition areas, and other pesticide and nitrate-N data. These GIS layers and associated database information are used to generate maps of statewide pesticide and nitrate-N detections in wells, as well as maps for chapter ATCP 30, Wis. Adm. Code (Pesticide Product Restrictions). For example, see the map of "Private Wells Tested for Atrazine in Wisconsin" in Chapter 4, *Condition of the Groundwater Resource*. Other GIS analyses involve identifying groundwater wells that may be impacted by point sources of pesticide and nitrate-N contamination. DATCP also uses global positioning system (GPS) receivers to locate and map wells and other features, such as agrichemical facilities and spill sites, that may affect groundwater quality.

For further information, visit the following web site (http://www.datcp.state.wi.us) or contact Kathy Pielsticker, DATCP, 2811 Agriculture Drive, PO Box 8911, Madison, Wisconsin, 53708-8911; phone: 608-224-4567; e-mail:kathy.pielsticker@datcp.state.wi.us.

DEPARTMENT OF COMMERCE

Two of the seven Divisions of the Department of Commerce regulate activities, protect or remediate Wisconsin’s groundwater resources.

Within the Division of Safety and Buildings, two programs have the responsibility of safeguarding public health and the waters of the State. Graywater reuse and stormwater is regulated by the Plumbing Program (Admin. Code Comm 82) and private onsite wastewater treatment systems by the Private Onsite Wastewater Treatment Systems Program (Admin. Code Comm 83).

Within the Division of Environmental and Regulatory Services (ERS), two bureaus regulate petroleum tanks and petroleum cleanups: The Bureau of Petroleum Products and Tanks regulates flammable and combustible liquids and hazardous substance liquids (Admin. Code Comm 10).

The Bureau of PECFA reimburses owners and operators of leaking petroleum storage tanks (Admin Code Comm 47) and has regulatory jurisdiction of petroleum sites determined to be a low or medium risk to the environment (Admin Code Comm 46).

Plumbing – Reuse, Stormwater and Private Onsite Wastewater Treatment Systems (POWTS)

In addition to public health and safety, the water supply and quality issues facing Wisconsin are a focus of the General Plumbing and POWTS programs in the Department of Commerce.

General Plumbing – Reuse and Stormwater Use. The Department plumbing code includes standards for reuse of gray water and stormwater. Currently, with revised stormwater rules, plumbing will be integrally involved with the design and installation of storm systems complying with NR 151.

Private Onsite Wastewater Treatment Systems (POWTS). The Department continues to communicate with the Department of Natural Resources regarding mutual issues such as large onsite sewage systems, mixed wastewater treatment systems and Underground Injection Control (UIC) regulations. The Department has increased its communication with the USEPA Region 5 office regarding POWTS related matters. Department staff continue to participate in an effort to develop a national model code related to onsite sewage systems.

Petroleum Product and Hazardous Substance Storage Tanks

The ERS Division continues to maintain regulatory oversight of aboveground and underground petroleum and CERCLA hazardous substance storage tanks in the Comm 10 administrative code. Underground storage tank regulations include the Federal EPA Underground Storage Tank (UST) requirements, as well as heating fuels, tanks supplying stationary combustion engines such as emergency generators, and other tanks storing regulated liquid products. Comm 10 is progressing with the Phase II revision to address technical requirements associated with current day concerns, trends and technology.

Since 1991 the database inventory of petroleum product tanks regulated under Comm 10 has increased from 143,681 to 206,695 USTs as previously unregistered tanks have become registered. In 1991 the database included 68,056 tanks classified as federally regulated with 51,088 of those tanks in use. As of June 19, 2006 the database reflects 80,319 federally regulated tanks with only 12,402 tanks in use and 254 in temporary-out-of-service status. In order to maintain a federally regulated tank in use, the tank must have a valid “permit-to-operate.” Permit renewal administrative review includes compliance assessment of the owner’s financial responsibility. Federally regulated and large fuel oil USTs are subject to periodic inspections involve verification of leak detection, spill and overfill protection, and record keeping.

Program tank permit initiatives have resulted in approximately 92% of the tanks required to have financial responsibility being in compliance with the rule. The remaining tanks will not be permitted and will be shut-down if financial responsibility coverage is not verified. The closure of federally regulated tanks will continue, but at a slower pace than experienced over the past few years. Closure of out-of-service residential heating fuel tanks is continuing as realtors and lenders recognize the potential problems and liability.

The closure of underground storage tanks is being supplanted by private fueling moving to retail fueling and some operators moving storage tanks to above ground. Residential heating fuel has

not been significantly impacted, as the closures are generally associated with the conversion to natural gas or liquid propane gas (LPG).

Proactive educational outreach efforts and annual inspections by the Department and its agents have resulted in a high level of regulatory compliance, and a reduction of system failures and environmental contamination. The ongoing regulatory challenges are owner operational compliance with leak detection. Wisconsin's progress and regulatory oversight continues to reflect very favorably with the US EPA.

Petroleum Environmental Cleanup Fund Act (PECFA)

Since 1989, the PECFA program has reimbursed approximately $1.45 billion to petroleum storage tank system owners for costs associated with the investigation and remediation of petroleum contaminated sites. The program, in addition to auditing owner invoices and authorizing payments, performs technical reviews of site investigations, evaluates the feasibility of remedial options, conducts a competitive public bid process for scopes of work, and makes decisions regarding closures for the majority of the State’s leaking underground storage tank (LUST) sites.

The petroleum inspection fee supports PECFA's spending authority. The spending authority was $40.4 million in FY06 and is $37.6 million for FY07. In FY05, the PECFA program reimbursed $47.2 million to 1284 claimants. In FY06, the PECFA program reimbursed $21.3 million to 825 claimants. Currently, costs claimed per month are at or below the monthly spending authority and the program provides reimbursement within approximately three to four months of receiving the claim.

The previous budget bill eliminated the PECFA bonding authority and reduced the Petroleum Inspection Fee by one cent as of 5/1/06. The proceeds from the sale of revenue bonds were used to pay down the backlog of audited claims awaiting payment. The total current outstanding debt is $752 Thousand.

In addition to administering the PECFA fund, the Department of Commerce PECFA Bureau has the administrative authority for low and medium risk petroleum contaminated sites (which includes both soil and groundwater sites). The Bureau closes approximately 200 sites per year.

Data Management

Commerce is continuing its data integration information technology (IT) initiative. With regard to groundwater protection, Commerce maintains databases of underground petroleum storage tank systems and properties with petroleum contamination either in the past or currently. This year, the PECFA Bureau has introduced web reporting to the environmental consulting industry. Environmental consultants will provide data regarding groundwater and soil contaminant levels via the Internet. The data is directly entered into the Department’s database and is available immediately to staff for review. The database also stores information on activities associated with on-site sewage system design, installation and maintenance. The Department continues to participate in discussions with county code administrators, service providers and other interested parties relative to reporting and recording of inspection, maintenance and servicing events for onsite sewage systems. Governmental units continue to enhance their maintenance reporting abilities. More are expected to follow in the future as the department begins implementation of POWTS program related provisions contained in 2005 Wisconsin Act 347.

For more information, visit the following web site (http://www.commerce.state.wi.us) or contact Berni Mattsson, ERS Division Administrator, P. O. Box 7839, Madison, Wisconsin 53707-7839, phone: 608-266-9403, fax: 608-267-1381; e-mail bmattson@commerce.state.wi.us.

DEPARTMENT OF TRANSPORTATION

The Department of Transportation (DOT) regulates the storage of highway salt (ss. 85.17 and 85.18, Wis. Stats.) to protect the waters of the state from harm due to contamination by dissolved chloride. DOT is also responsible for potable well sampling at 29 rest areas and 73 waysides. Other DOT groundwater related activities include: road salt research; hazardous material and waste investigation or remediation; wetland compensation and research; and storm water management and research. Various divisions and sections in DOT are responsible for these activities:

- Salt Use and Storage - Bureau of Highway Operations
- Salt Research - Bureau of Highway Construction (Geotechnical Section)
- Hazardous Materials (petroleum) - Environmental Services Section
- Hazardous Waste - Environmental Services Section
- Wetlands - Environmental Services Section
- Erosion Control and Storm Water Management - Environmental Services Section
- Rest Area Potable Well Sampling - Bureau of Highway Operations

Salt Storage

Highway salt is stored statewide by suppliers, counties, cities, villages, and private companies. Annual inspections occur and reports are provided for salt storage sites to insure that storage practices are in accordance with ch. Trans 277, Wis. Adm. Code (Highway Salt Storage Requirements). The intent of the Code is to help prevent entry of highway salts into waters of the state from storage facilities. All salt must be covered and stored on an impermeable base. The base for stockpiles is required to function as a holding basin and to prevent runoff. The covers must consist of impermeable materials or structures to prevent contact with precipitation. State funded facilities are being added to the DOT salt storage program to provide greater capacity of indoor storage. This will improve groundwater protection and create greater flexibility for scheduling salt purchase at optimal prices.

The DOT annually updates salt storage facility records into a database and assists the DNR source water protection program in locating salt storage facilities for GIS mapping applications. There are currently 1,219 salt storage sites listed in the database and 2,320 sub-sites. Each county keeps detailed inventories of salt which are updated monthly. Facility inventories, inspections, repairs and improvements are included in the database.

Salt Use

The DOT Bureau of Highway Operations produces the Annual Winter Maintenance Report describing statewide salt use based on weekly reports from each county. Current policy in the State Highway Maintenance Manual restricts the spreading of deicer salts to a maximum of 400 pounds per lane mile per initial application, and 300 pounds per lane mile for subsequent applications. Electronic controls for salt spreader trucks are continually tested to record and verify application rates and coverage effectiveness. Other technology is used on county highway patrol trucks to keep salt on pavement surfaces (e.g., zero-velocity spreaders, ground speed

controllers, and onboard liquid pre-wetting units). Additional efforts to minimize and conserve salt applications include the use of in-situ weather monitoring system. Pavement temperature sensors recorded at 62 locations along major highway routes are used to determine application methods. Annual training for snowplowing and salt spreading techniques is provided for county snowplow operators.

Salt Monitoring and Research

Since 1970, DOT has investigated potential road salt impacts on the environment adjacent to highways. Early investigations (1970s to early 80s) were focused on evaluating road salt impacts to surface water runoff, vegetation, and soils. In the last several years DOT has conducted limited investigations evaluating road salt impacts to groundwater. Approximately 20 sites throughout the state have been studied. In general, 1 or 2 shallow monitoring wells at each site were monitored quarterly for a period of 5 years. The monitoring consists of analyzing soil, water, or vegetation samples for calcium, sodium, chloride, and electrical conductivity. Approximately 5 sites are currently monitored, and new sites are added periodically. Results from the studies are discussed in 5 separate DOT progress reports entitled: Investigation of Road Salt Content of Soil, Water and Vegetation Adjacent to Highways in Wisconsin (1972, 1975, 1979, 1989 and 1996).

For more information, visit the following web site (http://www.dot.state.wi.us) or contact Mr. Dan Scudder, Chief, Environmental Services Section, Room 451, P. O. Box 7965, Madison, Wisconsin 53707-7965; phone: 608-267-3615, or e-mail dan.scudder@dot.state.wi.us.

DEPARTMENT OF HEALTH AND FAMILY SERVICES

Chapter 160, Wis. Stats., directs the Department of Health and Family Services (DHFS) to recommend health-based enforcement standards for substances found in groundwater and specifies the protocol for developing the recommended standards. Recommended standards are sent to the DNR and are submitted through the rule-making process as amendments to ch. NR 140, Wis. Adm. Code. DHFS staff serve as a primary resource for information about the health risks posed by drinking water contaminants, and are charged with investigating suspected cases of water-borne illness. Toxicologists, public health educators, and epidemiologists employed in the Department's Division of Public Health present this information to the public at meetings and conferences, and provide direct assistance to Wisconsin families via home visits, letters to well owners, and telephone consultations. DHFS staff review correspondence sent to well owners by DNR representatives. The agency frequently provides supplemental advice to owners of wells that are highly contaminated with volatile substances such as benzene and vinyl chloride, especially in cases where the contaminants may pose concerns from inhalation of indoor air. Follow-up letters sent by DHFS explain the health effects of specific contaminants and suggest strategies for reducing exposure until a safe water supply can be established. DHFS staff are called upon to review the toxicity of constituents of well construction and rehabilitation products to ensure that products approved for use in Wisconsin can be used safely without risk of chemical overexposure. DHFS prepares and distributes a wide variety of informational materials on groundwater and drinking water issues related to human health.

Summary of Agency Activities in FY 06

In December of 2005, DHFS sponsored a conference in Madison for local health department staff and others interested in environmental health hazards. The program included several

presentations on local health responses to chemical and bacteriological groundwater contamination events, and on the application of GIS technology to the management of groundwater quality.

Over the past four years, DHFS has worked on developing environmental public health tracking (EPHT) modules for childhood cancer, multiple sclerosis (MS) and amyotrophic lateral sclerosis (ALS) to create data systems that link information on relevant hazards, exposures and health outcomes. In support of this initiative, DHFS is working with DNR to access groundwater and drinking water data to create exposure profiles and generate environmental hypotheses about the etiology of these conditions. As part of this cooperative agreement, DHFS has identified and developed environmental public health indicators of priority drinking water contaminants such as total trihalomethanes (TTHMs) and arsenic in community water supplies, and county-level indicators of nitrate contamination of private wells. Additional county level indicators describing the proportion of the total population served by private or public wells, and surface or groundwater drinking water sources have also been developed. All indicators serve as tools to assist in developing future targeted environmental health analyses. Other partners in this initiative include DATCP, the Wisconsin State Laboratory of Hygiene, and the UW's Division of Information Technology (DoIT) and School of Medicine and Public Health.

Throughout 2005 and 2006, DHFS oversaw the implementation of multiple environmental public health projects relating to groundwater-related issues. DHFS staff developed a screening level tool that uses a hazard risk score to estimate where the potential for exposure to agricultural pesticides in groundwater is greatest. The algorithm integrates datasets from DNR and DATCP to characterize the potential for exposure at various geopolitical boundaries. DHFS also worked with DATCP to use previous survey sampling results to explore the relationship between nitrates and pesticides in private wells. The analysis showed a clear trend towards a higher proportion of pesticide detections as the concentration of nitrate-N increases in wells; however, the strength and magnitude of the relationship varied by agricultural regions. This suggests that the relationship is also dependent upon variations in agricultural practices, crop production, geology and soil type.

In 2006, DHFS has also been integral in national CDC-supported initiatives to explore the utility and feasibility of incorporating consistent and comparable drinking water contaminant measures onto a national environmental public health tracking (EPHT) network. DHFS staff co-chair the drinking water workgroup of the State Environmental Health Indicators Collaborative (SEHIC), in which state Safe Drinking Water Information Systems (SDWIS) data have been evaluated for development of state level public health indicators. Through SEHIC, DHFS established partnerships with the U.S. Geological Survey (USGS) to map and explore geological predicators of groundwater contamination in the state. DHFS has also been an active participant in a national Drinking Water Exposure Methods Workgroup, which has sought to improve methods of estimating community-level contaminant exposures based on monitoring data and water distribution system parameters. The workgroup developed an online tool to survey water utilities and wrote guidance to identify relevant drinking water data and critical data gaps for estimating exposures and using existing data resources in public health assessments.

For more information, visit http://dhfs.wisconsin.gov/eh/Water/, or contact Henry Anderson (608-266-1253; anderha@dhfs.state.wi.us), Lynda Knobeloch (608-266-0923; knobelm@dhfs.state.wi.us) or Mark Werner (608-266-7480; wernema@dhfs.state.wi.us), 1 W. Wilson St., Rm. 150, Madison, Wisconsin, 53702.

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

The Wisconsin Geological and Natural History Survey (WGNHS), University of Wisconsin-Extension, performs basic and applied groundwater research and provides technical assistance, maps, and other information and education to aid in the management of Wisconsin's groundwater resources. The WGNHS groundwater program is complemented by the geology and soils programs, which provide maps and research-based information essential to the understanding of groundwater recharge, occurrence, quality, and movement.

Highlights of the WGNHS groundwater activities for FY 06 include the following:

Groundwater-level monitoring network

Wisconsin's statewide groundwater-level monitoring network has been operated jointly with the U.S. Geological Survey (USGS) since 1946. Currently, the network consists of approximately 140 wells in 66 counties. The groundwater-level monitoring network provides a consistent, long-term record of fluctuations in water levels in deep and shallow aquifers. Such information is critical for accurate analyses of the effects of high-capacity wells pumping, the response of groundwater levels to droughts, and the effects of land-use changes on groundwater systems. The WGNHS will continue to supply the information to public and private clients and aid in data interpretation. For available data see http://wi.water.usgs.gov/public/gw/.

County groundwater studies.

Geologic and groundwater studies at the county scale continue to be an important part of WGNHS programs. During 2005 the Survey initiated or carried out geologic and/or groundwater studies in the following counties: Dane, Calumet, Fond du Lac, Iowa, Outagamie, Pierce, St Croix, Sauk, Washington, Waukesha, and Winnebago. Many of these studies will generate or have generated water-table maps. For a current list of available county-scale water-table maps see http://www.uwex.edu/wgnhs/watertable1.htm.

Regional groundwater studies

Regional geologic and groundwater studies usually span multiple counties. During FY 06 the WGNHS was involved in several regional projects, including the following:

a. Geologic and hydrogeologic analyses in southeastern Wisconsin. The WGNHS conducted regional groundwater modeling in the SEWRPC (Southeastern Wisconsin Regional Planning Commission) region, spanning seven counties in SE Wisconsin. (see http://www.uwex.edu/wgnhs/gw_se_wisc.htm and http://water.usgs.gov/pubs/fs/fs-116-03/)

b. Development of well-drilling guidelines for the Lower Fox River Valley. This effort assisted the DNR in developing casing guidelines to reduce potential arsenic contamination in private wells. See http://www.dnr.state.wi.us/org/water/dwg/arsenic/casingrequire.htm

c. Geologic mapping and groundwater investigations. With funding from the federal STATEMAP program and additional funding from the UW Groundwater Research Advisory Council (GRAC), WGNHS scientists are preparing new geologic maps and acquiring new groundwater data for Iowa, Pierce, Polk, and St Croix Counties.

Groundwater Research Activities

The WGNHS carries out specific groundwater research projects focused on understanding topics important to groundwater use and management in Wisconsin and elsewhere. Active projects during FY05 include the following:

a. *Methods of investigating aquitards.* Aquitards, low-permeability geologic materials such as clay or shale, are critical resources for protecting water-supply wells from contamination, yet are often difficult to characterize. In late 2005 the WGNHS completed a project funded by the American Water Works Association Research Foundation (AWWARF) for evaluation of the properties of aquitards. See http://www.awwarf.org/research/topicsandprojects/execSum/2780.aspx

b. *Arsenic in groundwater*. The WGNHS is continuing research on the source(s) and geochemical characteristics of arsenic contamination in water-supply wells in northeastern and southeastern Wisconsin.

c. *Groundwater recharge.* Groundwater recharge is critical to maintaining the supply of Wisconsin's groundwater, but mapping and quantifying recharge areas and rates can be a difficult process. In cooperation with UW-Madison, the WGNHS has developed a computerized technique for rapidly delineating recharge areas for use in regional groundwater models. Currently, the WGNHS is incorporating the recharge delineation methodology into new projects and is cooperating with the USGS in using it in other areas of Wisconsin.

d. *Fluid flow in fractured rocks.* Fractured rocks (limestone, dolomite and crystalline rocks) underlie much of Wisconsin and form important aquifers over large parts of the state. Groundwater in carbonate rocks can move through fractures and solution features. Groundwater velocities in such rocks can be unusually high, and the rocks usually have very low ability to attenuate contaminants. Work by the WGNHS on carbonate aquifers in eastern Wisconsin suggests that detailed stratigraphic analysis, coupled with geophysical and hydrogeologic data, may help predict the hydraulic properties of these complex and vulnerable aquifers.

   Karst features, including a variety of sinkholes, cavities, and solution openings, commonly are found in carbonate rock (limestone and dolomite). In recent years there has been increased concern about the hazards and effects of karst features in many parts of Wisconsin, but little published information has been available. The WGNHS is serving as a clearinghouse for karst information, and has begun assembling a karst database for the state: http://www.uwex.edu/wgnhs/karst.htm.

e. *Investigation of unsewered rural subdivisions*. Population growth and urban expansion in many areas has resulted in residential development on formerly agricultural land, but there have been few studies of the impacts of such developments on groundwater quality. To document the effects of this land-use conversion on groundwater quality, the WGNHS initiated a monitoring program to collect water-quality data before, during, and after construction of a new, unsewered subdivision located on agricultural land several miles outside of Madison, Wisconsin. See http://www.uwex.edu/wgnhs/pdfs/staffpdf/WilcoxBradburyetal2005.pdf

f. *Groundwater use*. This project began in FY 05 and focuses on determining the cause of exponential growth in groundwater pumping that has occurred in Waukesha County over

the last several decades, and compare this to changes in groundwater pumping that have occurred in a predominantly rural area (Sauk County). This study, funded by the USGS and the Water Resources Institute, will also evaluate methods for tracking groundwater pumping in Wisconsin.

g. *Hydrogeology/geochemistry in southeast Wisconsin.* A major issue facing water managers and users in eastern Wisconsin is a high, and in certain wells, increasing concentration of TDS and radioactivity in the deep sandstone aquifer. WGNHS scientists are working with USGS and UW-Milwaukee personnel to investigate these issues in Waukesha County. See http://www.wri.wisc.edu/Project-Grundl.html.

h. *Springs in Wisconsin.* During FY07 the WGNHS will also contribute to the understanding of springs in Wisconsin by providing office space, records, and other assistance to an employee of the Wisconsin Wildlife Federation who is developing a statewide springs inventory. This work is an outgrowth of the 2003 Groundwater Quantity Legislation and seeks to determine the numbers and types of springs that would be protected under that legislation.

Groundwater data management

During FY 06 the WGNHS continued to collect geologic and groundwater data and provide this data to a variety of users. Significant efforts include the following:

a. *WiscLith database*. The Survey has developed and distributed a digital database, called *wisc*LITH, that contains lithologic and stratigraphic descriptions of geologic samples collected from across the state. This database was updated during 2004. Current work efforts aim to improve the quantity of data for areas of the state where there are active geologic and hydrogeologic projects, and to improve quality control and consistency of information in the state-wide database. See http://www.uwex.edu/wgnhs/wisclith.htm

b. *Well construction reports.* The WGNHS serves as the repository for 1936–1995 Well Constructor's Reports, one- to two-page reports that are usually submitted to the DNR by a well driller within a few months of a well's completion. The database and scanned images are now available to state agencies, consulting firms, and private well owners on CD-ROM. See http://www.uwex.edu/wgnhs/wcrs.htm

c. *Tillpro Database*. TILLPRO is primarily a database of grain-size analyses performed on unlithified sediment samples collected from Wisconsin and analyzed in the Quaternary Laboratory at the Department of Geology and Geophysics, University of Wisconsin-Madison. During 2004 the WGNHS released this database for public distribution on CD-ROM. See http://www.uwex.edu/wgnhs/wisclith.htm

d. *New core and sample repository*. During 2004 the WGNHS acquired space for storage of geologic records, core samples, and other materials in Mt Horeb, Wisconsin. See http://www.uwex.edu/wgnhs/core.pdf

Groundwater education

WGNHS groundwater education programs for the general public are usually coordinated with the UW-Extension network of county-based faculty, the DNR, the Central Wisconsin Groundwater Center, or the UW-Extension Environmental Resources Center. The WGNHS also produces and serves as a distributor of many groundwater educational publications and visual aids. In FY 06

WGNHS staff members plan to participate in groundwater educational meetings in counties where county mapping and/or other hydrogeologic studies are in progress. Arsenic in groundwater and the potential groundwater implications of proposed quarries, gravel pits, and high-capacity wells have been popular topics recently and probably will continue to provide educational opportunities in FY 07. Geologic and hydrogeologic field trips for DNR water staff and new DNR employees have been held in the past and will continue in FY 07.

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UNIVERSITY OF WISCONSIN SYSTEM

The University of Wisconsin System (UWS) has research, teaching and outreach responsibilities. These three missions are integrated through cooperation and joint appointments of teaching, research and Extension personnel who work on groundwater issues. UWS staff members work with state and federal agencies and other partners to solve groundwater resource issues. Citizen outreach is accomplished through use of publications, news media, public meetings, teleconferences, and water testing and satellite programs. Activities of several specific programs follow.

The UW Water Resources Institute (WRI)

The UW Water Resources Institute (WRI) is one of 54 water resources institutes located at Land Grant universities across the nation. It promotes research, training, and information dissemination focused on the nation's water resources problems.

Research. The WRI research portfolio includes interdisciplinary projects in four broad areas: groundwater, surface water, groundwater-surface water interactions, and drinking water. Groundwater is a top priority and an area of particular strength at the WRI. Key areas of emphasis

in FY 06 included identifying contamination of groundwater by pharmaceuticals and other endocrine disrupting compounds in groundwater, addressing groundwater resources in Wisconsin's Smart Growth planning, and developing treatment processes for pesticides and arsenic.

During FY 06, the WRI directed a wide-ranging program of priority groundwater research consisting of 12 projects. These included short- and long-term studies both applied and fundamental in nature. They provide a balanced program of laboratory, field, and computer-modeling studies and applications aimed at preserving or improving groundwater quality. Groundwater problems investigated during the past year include:

- Applying a screening technique to test for the presence of endocrine disrupting compounds in groundwater;
- Assessing the use of slag from steel processing for treatment of arsenic in groundwater;
- Determination of the role of hyporheic zones (layers of sediment beneath or adjacent to a stream) in the production and transport of methylmercury;
- Determination of the influence of trees on groundwater pesticide remediation;
- Testing the use of "rain gardens" for receiving runoff and recharging local aquifers;
- A better understanding of groundwater flow through a fen-stream complex in northern Wisconsin;
- Determining the processes affecting water infiltration through the uppermost soil levels;
- An investigation of the links between antibiotics leaching from onsite wastewater treatment systems and antibiotic resistance of microbes in groundwater;
- A study of speciation of arsenic in groundwater arsenic and its relationship to geochemical characteristics of the surrounding sedimentary deposits;
- Determination of permeability of volatile organic compounds through composite liners in landfills;
- Better understanding the ecological importance and determining indicators of springs in Wisconsin;
- Understanding how pesticides and fertilizers penetrate soils and enter subsurface aquifers in the unglaciated region of Wisconsin; and,
- Understanding how groundwater responds to climatic fluctations in the upper Midwest.

These 12 funded projects provided training in several disciplines for post-doctoral research associates, graduate student research assistants and undergraduate students at UW-Madison, UW-Milwaukee, UW-Stevens Point, UW-Extension and UW-Parkside.

The UWS selected eight new groundwater research projects from this year's Solicitation for Proposals for support during FY 07 (July 1, 2006–June 30, 2007) (see Table 2). Four projects, selected from the previous year's solicitation, will receive continuation support during FY 06. The new projects are based at UW-Madison and UW-Milwaukee.

Teaching. Institutions within the UWS continue to offer undergraduate- and graduate-level courses and programs focusing on diverse issues regarding groundwater resources. Additionally, several campuses offer for-credit, field-oriented water curriculum courses for middle and high school teachers during summer sessions. The WRI views education as an important component of its total program and recognizes the importance of K-12 education as a fundamental component of its outreach and training effort. The WRI distributes two publications—*Local Watershed Problem Studies-Elementary Activities* and *Local Watershed Problem Studies-Middle and High School Curricula Guide*—upon request. These two guides assist educators in the development

and dissemination of curricula concerning soil and water resources. In addition, the UW-Madison Water Resources Library has purchased a number of other guides with innovative approaches to teaching water-related science in K-12 classes.

Grants administration. WRI staff members developed a Web site that enables online proposal submission and review of the FY 07 Joint Solicitation of Groundwater and Related Research and Monitoring Proposals. The site allows investigators to submit proposals one section at a time, as they are completed, rather than waiting until the entire proposal document is finished. Having proposals in electronic format also makes the proposal peer-review process more convenient. Reviewers can log on to the site and review proposals at their convenience. Review packets for the GRAC funding meeting are generated directly from this Web-based database.

Water Resources Publications

In February 2006, WRI and the UW-Madison Department of Civil & Environmental Engineering published "Design Guidelines for Stormwater Bioretention Facilities" by Dustin Atchison, Ken Potter and Linda Severson. This manual provides design guidelines and a numerical model (RECARGA) that can be used for creating bioretention facilities for small-scale stormwater management that promotes infiltration of storm water in order to reduce its volume, improve its quality and increase groundwater recharge. A basic bioretention facility is commonly referred to as a rain garden. It is a landscaped garden in a shallow depression that receives storm water from nearby impervious surfaces.

UW Water Resources Library Outreach Activities

During the past year, the UW Water Resources Library maintained its involvement in outreach while continuing to serve university system faculty, staff and students. A highlight of the past year was the launch of a new library outreach Web site, **Wisconsin's Water Library for Kids** (*aqua.wisc.edu/waterlibrary/kids*). From Dr. Seuss to a simple explanation of the water cycle, "Wisconsin's Water Library for Kids" features children's books with aquatic themes that have won awards or appeared on best books lists. Most books are for preschool through second grade children, although there are also materials for older kids. Besides fiction and nonfiction books, the Web site also has ideas and resources for story hours. Users can browse recommended reading lists by topic (frogs, fish and fishing, Great Lakes, water pollution, etc.) and age group. Any adult Wisconsin resident can check out books online and pick them up at their local public library. Library staff involved three students from the UW School of Library and Information Studies in the development of the site. Tina Yao, the ASC Art Director, used pictures from the Water Library's Allied Drive Story Hour series to design the site.

Library staff also continued to be involved in the "Allied Drive Story Hours" doing a story hour in July 2005 based on picture books about frogs. Allied Drive is a neighborhood of Madison, Wisconsin which is pocket of poverty and crime. The "Allied Drive Story Hours" began during the summer 2004 when the Water Resources Library launched the first of a series of story hour programs. The project has since become a partnership between six other specialized campus libraries, the UW-Madison School of Library and Information Studies, and the Madison School and Community Recreation Safe Haven Childcare Program. The library's July story hour received television coverage.

Web Sites

WRI maintains several other Web sites in addition to the site for the Eight International Conference on Mercury as a Global Pollutant described above. The **UW Water Resources Institute Web Site** (*wri.wisc.edu*) introduces users to the Wisconsin program and includes a variety of information for those interested in water-related issues and research. During the past

year, the following sections were updated: project listing, groundwater research database, funding opportunities and conference information.

The **ASC Publications Store** (*www.aqua.wisc.edu/publications*) features publications from both the Water Resources and Sea Grant Institutes. During the reporting period, the publication described above, "Design Guidelines for Stormwater Bioretention Facilities" was added to the online store.

The **Wisconsin Water Policy Inventory** (*www.aqua.wisc.edu/waterpolicy*) is a web-based tool for researching the state's major policies pertaining to water. This project enables Wisconsinites to browse state policies by category or to search using keywords.

Library Web Sites

In addition to the new **Wisconsin's Water Library for Kids** described above, the Water Resources Library maintains several Web sites, all of which were updated during the past year. The **Water Resources Library Web Site** (*wri.wisc.edu/library*) introduces UW-Madison faculty, staff and students to the library services tailored to them. Two of the most popular pages on that site are "Guide to Finding a Water-Related Job" (*wri.wisc.edu/library/finding_jobsall.html*) and "Guide to Finding Water-Related Information" (*library.wisc.edu/guides/WaterResources/index.htm*).

Wisconsin's Water Library (*aqua.wisc.edu/waterlibrary*) continues to make the books and other materials of the Water Resources Library available to any Wisconsin resident. During the past year, staff updated the entire site and added several special features or annotated reading lists on popular topics, including "Great Lakes Ships and Shipping", "Did you know? Learn more about Wisconsin Waters and the Great Lakes", and "Aquaculture, A Resource Guide". The most popular pages on the Water Library are "Wisconsin Water Facts" (*aqua.wisc.edu/waterlibrary/facts.asp*), "Native Americans and the Environment" (*aqua.wisc.edu/waterlibrary/nativeamericans.asp*) and "Environmentally-friendly Lawn and Garden Care" (*aqua.wisc.edu/waterlibrary/lawn.asp*).

The popularity of the library Web sites continues to grow. From August 2003 to April 2006, the number of visits per day to the Water Library Web site has grown from 45 to about 300. The average user likes what he sees and spends about 10 minutes on the site. Our library sites (Wisconsin's Water Library + Water Resources Library + our material on the UW-Madison Libraries site) currently receive over 500 unique visits per day.

UW System Publications Resulting from Wisconsin Groundwater Research and Monitoring Program Projects in FY06

Armstrong, D. 2005. Role of the hyporheic zone in methylmercury production and transport to Lake Superior. Water Resources Institute, University of Wisconsin, Madison. 1 vol.

Brander, K. E.; Owen, K. E., and Potter, K. W. Modeled impacts of development type on runoff volume and infiltration performance, Journal of the American Water Resources Association, 40(4), 961-970, 2004.

Cherkauer, D.S. and S.A. Ansari, 2005. Estimating ground water recharge from topography, hydrogeology and land cover. Ground Water 43(1)

Dussaillant, A. R.; Wu, C., and Potter, K.W. Richards equation model of a rain garden, Journal of Hydrologic Engineering, ASCE, 9(3), 219-225, 2004.

Eaton, T.T., and Bradbury, K.R. 2005. What happens when the confined Cambrian Ordovician aquifer in Southeastern Wisconsin begins to be dewatered? Water Resources Institute, University of Wisconsin, Madison. 19p.

Gu, C., and Karthikeyan, K.G., Interaction of tetracycline with aluminum and iron hydrous oxides., Environ. Sci. Technol., 39,2660-2667, 2005.

Gu, C.; and Karthikeyan, K.G. Sorption of the antimicrobial ciprofloxacin to aluminum and iron hydrous oxides. Environ. Sci. Technol. (in review – submitted June 2005).

Lowry, C.S., M.P. Anderson, R.J. Hunt. 2006. Modeling groundwater flow and heat transport within a fen/stream complex. MODFLOW and More 2006: Managing ground water systems, IGWMC, Golden, CO.

Masbruch, M.D., Hunt, R.J., and Anderson, M. P. 2005. Investigation of Three Flowpaths of Different Lengths, Allequash Basin, Vilas County, Wisconsin (*abstract).* Wisconsin's Waters: A Confluence of Perspectives: Delavan, WI, Wisconsin Section of the American Water Resources Association, p. 44.

Masbruch, M.D., Hunt, R.J., and Anderson, M. P. 2005. Delineation of Flow Paths and Processes Affecting Chemical Variability, Allequash Basin, Wisconsin (abstract). Geological Society of America Abstracts with Programs, Annual Meeting, Salt Lake City, Utah, October 2005.

Masbruch, M.D., 2005, Delineation of Source Areas and Characterization of Chemical Variability using Isotopes and Major Ion Chemistry, Allequash Basin, Wisconsin, MS Thesis, Department of Geology and Geophysics: Madison, WI, University of Wisconsin - Madison, 131 pp.

Olstadt, J., J.J. Schauer, J. Standridge, and S. Kluender. A Comparison of Ten US EPA Approved Total Coliform/E. *coli* Tests. Submitted to Journal of Water and Health.

Root, T.L. Arsenic in groundwater in southeastern Wisconsin: sources of arsenic and mechanisms of arsenic mobilization. Ph.D. thesis, University of Wisconsin-Madison, Department of Geology and Geophysics, expected spring 2005.

Root, T.L.; Bahr, J.M., and Gotkowitz, M.B. Controls on arsenic in groundwater in southeastern Wisconsin, in: Vlassopoulos, D.; Benning, L.; Meng, X., and O'Day, P., Advances in Arsenic Research, American Chemical Society Symposium Series, in press, 2005.

Skalbeck, J.D. 2004. Coupled modeling of gravity and aeromagnetic data for analysis of the Waukesha Fault, southeastern Wisconsin. Water Resources Institute, University of Wisconsin, Madison. 17 p.

Stoor, R.W., J.P. Hurley, C.L. Babiarz and D.E. Armstrong. 2006. Subsurface Sources of Methylmercury to Lake Superior from a Wetland-Forested Watershed. In Press. Science of the Total Environment.

For more information, visit http://www.wri.wisc.edu/ or contact Dr. Anders W. Andren, Director, UW-Madison Water Resources Institute, 1975 Willow Drive, Madison, WI 53706;

phone (608) 262-0905, fax (608) 263-2063, or email awandren@seagrant.wisc.edu.

UW-Extension's Central Wisconsin Groundwater Center

The Central Wisconsin Groundwater Center provides groundwater education and technical assistance to the citizens and governments of Wisconsin. Assistance includes answering citizen questions, helping communities with wellhead protection planning, describing the extent and causes of groundwater nonpoint pollution in Wisconsin, assessing drinking water quality, and working on groundwater policy. The center is part of the Center for Watershed Science and Education, an office of UW-Extension Cooperative Extension Service and the UW-Stevens Point College of Natural Resources, and frequently works through county Extension faculty in program delivery. More information can be found online at *http://www.uwsp.edu/cnr/gndwater/*.

Drinking Water Programs. In 2005, the Center assisted over 2,600 households in having their water tested in conjunction with county Extension offices and the Watershed Center's Water and Environmental Analysis Laboratory. Of these, 11% exceeded drinking water standards for nitrate-nitrogen. Seventeen percent of samples were unsafe because of coliform bacteria. Eleven Drinking Water Education Programs helped over 1,000 well users in seven counties to understand potential remedies for these problems and the relationship of land use practices to groundwater quality.

Water quality database. The Groundwater Center maintains a database of private well testing data from the Water and Environmental Analysis Regional Laboratory at UW-Stevens Point, and Drinking Water Education Programs conducted through the Center. There are currently over 400,000 individual test results for approximately 60,000 samples covering the state. Chemistry data includes pH, conductivity, alkalinity, total hardness, nitrate-nitrogen, chloride, saturation index, and coliform bacteria. In 1998, a new sampling program for iron, sodium, potassium, copper, lead, calcium, magnesium, manganese, zinc, and triazine was also initiated. Arsenic and sulfate were added late in 1999. The database primarily covers the period 1985 to the present. The database is PC-based and can be easily queried to be a significant source of information for local communities and groundwater managers. Forty-four counties are represented by 100 or more samples in the databases and 27 counties are represented by 500 or more samples.

Policy. The Center continues to play pivotal roles in a number of state groundwater issues. Working with partners in the private and public sectors on groundwater quantity policy and law has been a continuing priority for the Center. Center staff serves on the Technical Advisory Group of the Groundwater Advisory Council as well as the Northeast Wisconsin Karst and Manure Management Task Force.

Partnerships. Center staff works with agencies and private organizations, including the Wisconsin Agricultural Stewardship Initiative, Wisconsin Potato and Vegetable Growers Association Nonpoint Pollution subgroup, DATCP Atrazine Technical Advisory Committee, and Extension Nutrient Management Self-Directed Team. The Center continues to work closely with a number of Land Conservation Departments, Groundwater Guardian groups, and many local watershed based groups.

Other UW-Extension Water Programs

UW Environmental Resources Center (ERC). The UW Environmental Resources Center (ERC) develops and coordinates a number of national youth water education initiatives related to

groundwater. The ERC provides national coordination for two youth water education programs, *Educating Young People about Water* (EYPAW) and *Give Water a Hand* (GWAH).

EYPAW offers four guides and a water curricula database to provide assistance for developing a community-based, youth water education program. The EYPAW Web site, *http://www.uwex.edu/erc/eypaw*, provides access to a database of more than 190 water-related curricula that may be searched by grade level or water topic.

Goals of the GWAH curriculum are to protect and improve local water quality by encouraging youth to investigate local issues, and to plan and complete a service project. Youth then address a problem they identify with the assistance of a local natural resource expert. Program materials may be downloaded from the *Give Water a Hand* Web site, *http://www.uwex.edu/erc/gwah*.

Other ERC youth water education initiatives include:

- *Agua Pura* – a leader institute planning manual and guide for Latino water education
- *Evaluating USGS Water Education Resources* – an assessment of USGS materials to assist with USGS education program development decisions
- *Source Water Education* – a gap analyses of youth water curricula for source water education and riparian education resources.
- *Water Action Volunteers (WAV)* – a program for both kids and adults who want to learn about and improve the quality of Wisconsin's waterways through projects and hands-on activities.

Work continues on new water education initiatives including a national youth riparian curriculum, and the National Extension Water Outreach Education project to develop and promote best education practices for water education and to improve access to education resources and strategies. Find links to these programs on the ERC Web site at *http://www.uwex.edu/erc*.

UWS Farm and Home Environmental Management Program. The UWS Farm and Home Environmental Management Program, originally Farm*A*Syst and Home*A*Syst, enable and motivate urban and rural landowners, managers and residents to assess environmental and health risks and to take voluntary actions to prevent pollution. Projects focus on everything from long-term investments in structural design and siting to daily management practices.

The Wisconsin Dairy Environmental Management Systems (EMS) project, completed in 2005, collaborated with commodity and farm organizations, environmental organizations, government agencies and the private sector to test and evaluate the potential of EMS on Wisconsin dairies. Farmers engaged with EMS report improved profitability and a sense of greater control over environmental and health impacts, even in the face of rising regulatory scrutiny and greater international competition. The project work has also enhanced the statewide Green Tier program, which relies on EMS in regulating industries.

A grant from the North Central Region Sustainable Agriculture, Research and Education Program (NCR-SARE) is supporting research on six different regulatory and eco-label approaches to managing the environmental impacts of Midwestern dairy farming. Research involves identifying specific environmental goals of different programs and how they might be complemented with an Environmental Management System to strengthen farm sustainability. Methods include document analysis of various programs, including certified organic and NRCS program requirements, complemented by six farm case studies. Results will include

recommendations toward improving the policy and implementation of a range of environmental agricultural policies.

The Wisconsin Healthy Homes Project, a subset of Home*A*Syst, is contributing to a revision of the UWEX publication *Rent Smart.* Additional state Healthy Homes work will develop a pollution prevention resource website for Wisconsin citizens and Extension professionals.

The Farm & Home Program also concluded a two-year study of the use of Integrated Pest Management by professional landscapers in the Lake Monona Watershed. Data from this research was shared with community collaborators and used to develop a prototype outreach and education strategy to promote the use of IPM.
Visit: *http://www.uwex.edu/farmandhome/monona*.

Additional information is available at *http://www.uwex.edu/farmandhome/*.

Multi-Agency Land and Water Education Grant Program (MALWEG). UW-Extension coordinates the Multi-Agency Land and Water Education Grant Program (MALWEG), which has funded 134 groundwater-focused education projects since its inception in 1997. These projects have resulted in awards of over $1.8 million in educational assistance funds to county-based conservation professionals in Wisconsin who in turn deliver research-based best management practices and expertise into the hands of farmers on an individual basis.

MALWEG partners, such as US Department of Agriculture Cooperative State Research, Education and Extension Service and Natural Resource Conservation Service, UW-Extension, Wisconsin DNR, the Basin Education Program and Discovery Farms, have contributed funding and time to this milestone effort. The counties have also matched a considerable amount of resources to reach more than 1,400 farmers since 1997. More information can be found at *http://clean-water.uwex.edu/malweg/*.

Basin Education Initiative. The UWS cooperates on community-focused educational programs with other state agencies involved with water resources and natural resource issues. Since 1998, UW-Extension had worked in partnership with the DNR, USDA-NRCS, and local organizations and agencies to provide water and related natural resources education within the state's 22 major river basins. Fifteen Basin Educators work collaboratively at the local level and access state-level support for educational material development and program evaluation. The Basin Education Initiative works to support local conservation professionals such as county Extension agents, Land Conservation Department staff, and NRCS staff. The educational programs address a broad range of groundwater-related topics, including drinking water, threats to groundwater quality, impacts of land-use changes and land management decisions on groundwater quantity, information about localized groundwater problems such as karst geology, and a variety of other water quality issues. More information can be found at *http://basineducation.uwex.edu*.

UW Nutrient and Pest Management (NPM) program. In 1990 a broad coalition of agricultural organizations, environmentalists, and the University sought funding for a water quality program for farmers and the agricultural community. Over the past fourteen years, the NPM outreach program has conducted on-farm demonstrations and education throughout Wisconsin to address groundwater and surface water contamination from agriculture and the profitability of recommended practices.

A major portion of the program's focus has been nutrient management – the careful, profitable use of fertilizers and animal manures in crop production. NPM recently revised and distributed

the *Nutrient Management Farmer Education Curriculum* that includes a discussion of nitrates in groundwater. The curriculum has been taught throughout the state to hundreds of producers. NPM also coordinates training workshops for Nutrient Management Planners that teach agricultural and conservation professionals how to write nutrient management plans. To prevent pesticide contamination of groundwater resulting from field applications, the program delivered integrated pest management education and coordinated Wisconsin extension's WeedSoft development and delivery. WeedSoft is a computer program that helps growers makes cost effective, environmentally sound weed management decisions. One module includes leaching ratings to assist growers in herbicide selection.

NPM continues to work with Wisconsin farmers to ensure they are not over-applying nitrogen and other inputs so as to minimize potential losses to groundwater. The NPM field staff completed on-farm demonstrations, manure spreader calibration, and taught many farmers how to write and update their nutrient management plans. More information on these efforts and many publications are available at the NPM web site (*http://ipcm.wisc.edu*).

For more information on UW Extension programs related to groundwater, contact Ken Genskow, UW Environmental Resources Center, 1545 Observatory Drive, WI 53706-1289, phone (608) 262-0020, fax (608) 262-2031, or email kgenskow@wisc.edu; or George Kraft, Center for Watershed Science and Education, College of Natural Resources, UW-Stevens Point, Stevens Point, WI 54481; phone (715) 346-4270; email: gndwater@uwsp.edu.

Wisconsin State Laboratory of Hygiene

General program description. At the Wisconsin State Laboratory of Hygiene (WSLH), a great deal of effort is focused on identifying and monitoring chemical and microbial contaminants in groundwater through routine testing, emergency response, education and outreach, and specialized research. The activities related to groundwater span several departments at WSLH and, collectively, their efforts make up the WSLH Drinking Water Quality Program. The mission of the WSLH Drinking Water Quality Program is to protect the health of drinking water consumers by providing analytical expertise, research and educational services to the scientific and regulatory communities.

The chemical and microbial groundwater contaminants routinely tested for include all contaminants regulated by the federal Safe Drinking Water Act as well as many emerging contaminants that appear on the USEPA Contaminant Candidate List. Examples include: fecal indicators (total coliform, *E. coli*, coliphage), *Helicobacter pylori*, *E. coli* O157:H7, *Salmonella*, waterborne viruses, parasites (*Cryptosporidium*, *Giardia*, and microsporidia), radioactivity, inorganic compounds (mercury, nitrate, arsenic) and organic compounds (atrazine, PCBs, PBDEs).

Another important focus of the WSLH Drinking Water Quality Program is emergency response to incidences involving groundwater. For example, WSLH works with DHFS and DNR to investigate outbreaks of illnesses of unknown (possibly food or water) origin. Staff provides background information on the outbreaks for local public health officials, local media, and the general public. WSLH also responds to spills and incidents and supports state agencies in remediation and emergency clean-up activities. Most recently, WSLH has focused its efforts on enhancing and expanding terrorism response programs.

WSLH also provides educational and outreach activities related to groundwater and drinking water including: instructional consultations for well owners and well drillers; on-site training of municipal water supply operators; and tours for a variety of international, educational, regulatory, and other governmental groups. Staff has developed an interactive study guide dealing with safety, sampling, and chemistry for drinking water operators and publications related to drinking water. Staff attends and presents papers at a variety of conferences and symposia and publishes research finding in professional journals.

Summary of groundwater-related activities in FY 2006.
Two research projects funded by the UW System through the GCC's Groundwater Research and Monitoring Program in FY 05 were continued in FY 06:

Occurrence of Estrogenic Endocrine Disruptors in Groundwater. Jocelyn Hemming, PhD, Wisconsin State Laboratory of Hygiene.

A comparison of USEPA approved enzyme-based total coliform/E. coli tests for microbiological groundwater monitoring and laboratory consultation. Jeremy Olstadt, Wisconsin State Laboratory of Hygiene.

Research projects that were on-going or completed in FY 06 include:
Evaluation of Gross Alpha and Uranium Measurements for MCL Compliance. Michael F. Arndt, PhD, Wisconsin State Laboratory of Hygiene (funded by the American Water Works Association).

Assessment of endocrine disrupting chemical in water reclamation systems Jocelyn Hemming, PhD, Wisconsin State Laboratory of Hygiene (funded by the Water Environment Research Foundation).

Comparison of pesticide home water testing kits with certified analytical laboratory results. John Strauss, Wisconsin State Laboratory of Hygiene (funded by DNR).

For more information, visit the following website (http://www.slh.wisc.edu/) or contact William Sonzogni, Wisconsin State Laboratory of Hygiene, 2601 Agriculture Drive, Madison, WI 53703, phone (608) 224-6200, or email sonzogni@facstaff.wisc.edu.

FEDERAL AGENCY PARTNERS

U.S. Geological Survey: Water Resources Discipline - Wisconsin Water Science Center

The mission of the U.S. Geological Survey-Water Resources Discipline is to provide the hydrologic information and understanding needed for the optimum utilization and management of the Nation's water resources for the overall benefit of the people of the United States. This mission is accomplished, in large part, through cooperation with other Federal, State and local agencies, by:

- Collecting on a systematic basis data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- Conducting analytical and interpretive water-resource appraisals describing the occurrence,

availability, and physical, chemical, and biological characteristics of surface water and ground water.

- Conducting supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques and to understand hydrologic systems sufficiently well to quantitatively predict their response to stress.

- Disseminating the water data and the results of these investigations and research through reports, maps, computerized information services, and other forms of public releases.

- Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and groundwater.

- Providing scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies, to licensees of the Federal Energy Regulatory Commission, and to international agencies on behalf of the U.S. Department of State.

The Wisconsin Water Science Center is currently conducting cooperative projects that have a significant groundwater component with the DNR, WGNHS, Southeast Wisconsin Regional Planning Commission (SEWRPC), the Menominee, Stockbridge-Munsee, Ho-Chunk, and Lac Court Oreilles Tribes of Wisconsin, and the numerous county and city governments. In addition, several projects are funded by Federal agencies: EPA-Region 5, National Park Service, and USGS. Recent and current projects that have a significant groundwater component are listed below.

Cooperatively funded projects with state and local agencies:

1. Collection of data from the Wisconsin groundwater observation-well network.
2. Compilation of data for the Wisconsin water-use data file.
3. Investigation of the hydrology of southeastern Wisconsin and development of a Regional Water Supply Plan.
4. Quantification of the impacts of urbanization on infiltration in the Black Earth Creek watershed.
5. Evaluation of the effectiveness of Wisconsin closure protocols for petroleum contaminated sites.
6. Simulation of groundwater/surface-water systems in Pierce, St. Croix, and Polk Counties.
7. Evaluation of drinking water vulnerability.
8. Simulation of the effects of the Shell Lake water diversion, Washburn County, on the shallow groundwater – lake system.
9. Centralization of access to Wisconsin ground water data to encourage the consideration of ground water in all elements of comprehensive planning by communities and the state

Projects funded primarily by Federal agencies:

1. Availability and use of fresh water in the United States: Lake Michigan Pilot Study (USGS funded) http://water.usgs.gov/ogw/gwrp/activities/wateravail_pilot.html.
2. Hydrologic and biogeochemical budgets in temperate lakes and their watersheds, northern Wisconsin (USGS funded) http://infotrek.er.usgs.gov/doc/webb/index.html.

3. Western Lake Michigan Drainages National Water-Quality Assessment (USGS funded) *http://wi.water.usgs.gov/nawqa/index.html*.
4. Prediction of groundwater susceptibility to contaminants to protect the St. Croix National Scenic Riverway (National Park Service and USGS funded)
5. Spatial and temporal shallow groundwater recharge rates in Wisconsin (USGS funded).

The USGS contributed two significant accomplishments to help protect Wisconsin's groundwater in FY 06:

- In cooperation with the National Park Service a screening model was developed for simulating regional ground-water flow in the St. Croix River Basin. The screening model and associated hydrologic databases have provided a better understanding of the regional ground-water-flow system and its relation to stream drainage in the basin. Simulations using the calibrated screening model show ground-water-contributing areas for selected stream reaches, very useful for water-resource managers concerned with protection of fisheries and other resources. Model simulations also identify areas of the basin where ground-water travel time from the water table to streams and wells is relatively short (less than 50 years). This screening model is now being used as the framework for a ground-water flow modeling effort being undertaken by the USGS in cooperation with St. Croix, Pierce, and Polk Counties. A USGS report of the recently completed St. Croix River Basin study can be found at *http://pubs.usgs.gov/sir/2005/5283/*

- In cooperation with DNR and Marshfield Clinic a study was undertaken to investigate the susceptibility of La Crosse municipal wells to enteric virus contamination from surface Water contributions The primary objective of the study was to monitor the municipal drinking water wells of La Crosse for human gastrointestinal viruses and relate the amount of Mississippi River water infiltrating the wells to the frequency of virus detection. A secondary objective was to relate microbial indicators of water sanitary quality with the occurrence of gastrointestinal viruses. Study results indicate there are frequent occurrences of viral RNA in the La Crosse drinking water wells included in this study, some of which are attributable to surface water infiltration and the rest must be derived from another unidentified fecal source. To ascertain the public health significance of these findings it would be necessary to conduct an epidemiological study relating virus occurrence to a defined health endpoint. It is likely given the chlorination dose at each wellhead and residence time within the system that any viruses present in the groundwater are inactivated before ingestion. However, evaluations of the effectiveness of the present disinfection system were outside the scope of this research. This study was funded by grants from the Wisconsin Department of Natural Resources and funding provided by the U.S. Geological Survey Water Resources Cooperative Program. A final report containing more detailed information on this project is available for loan at the Water Resources Institute Library, University of Wisconsin - Madison, 1975 Willow Drive, Madison, Wisconsin 53706 (608) 262-3069

For more information please contact Charles Dunning USGS, 8505 Research Way, Middleton, Wisconsin, 53562-3581 (608-821-3827), cdunning@usgs.gov, Randy Hunt (608-821-3847), rjhunt@usgs.gov or visit the Wisconsin Water Science Center web page (http://wi.water.usgs.gov).

USDA Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) is a federal agency within the US Department of Agriculture. The NRCS, formerly the Soil Conservation Service, works with private landowners to promote conservation of natural resources. In Federal fiscal year 2005 (Oct. 1, 2004 to Sept. 30, 2005), NRCS planned over 587,000 acres of conservation systems and applied over 522,000 acres in Wisconsin in cooperation with county Land Conservation Departments.

The agency protects groundwater by providing technical assistance to landowners through the following ongoing conservation practices and programs:

- *Nutrient management*: management of the amount, form, placement and timing of nutrients applied to the soil so that the amount applied is only what is needed to produce optimum crop yield. This reduces the potential for applied nutrients to pollute surface and groundwater. Last year 1616 farmers implemented nutrient management plans totaling 151,400 acres through the Environmental Quality Incentives Program in Wisconsin.
- *Pest management*: utilization of environmentally sensitive prevention, avoidance, monitoring and suppression strategies to manage weeds, insects, diseases, animals and other organisms that directly or indirectly cause damage or annoyance. This enhances quantity and quality of commodities. It also minimizes negative impacts of pest control on soil resources, water resources, air resources, plant resources, animal resources and/or humans. Last year pest management was implimented on 11,300 acres
- *Animal waste storage*: proper waste storage siting and design is imperative to protect groundwater from contamination by nutrients in animal waste. Last year 80 animal manure storage structures were planned and 46 were installed.
- *Comprehensive Nutrient Management Plan (CNMP):* a conservation system unique to livestock farms. It is a grouping of conservation practices and management activities to insure both production and resource protection goals. It addresses soil erosion, manure, and organic by-product impact on surface and groundwater quality. CNMP components include nutrient management based on phosphorus or nitrogen, manure and wastewater handling and storage, adequate erosion control of cropland, and proper record keeping. CNMPs entail a thorough review of the farmstead, ensuring that manure and wastewater are properly stored and handled, stormwater remains clean or is captured, and drinking water wells are properly protected. It may also include feed management to reduce phosphorus in manure and other manure use alternatives such as biofuel production and composting. Last year, CNMPs were written for 163 farms and implemented on 57 farms.
- *Managed grazing:* Pastureland is divided into small paddocks and intensively grazed for 1 or 2 days and then rested for 25-35 days. About 330 prescribed grazing plans were written covering 27,000 acres. Prescribed grazing was applied to 24,000 acres. Some crop fields converted to managed grazing had 10 times less groundwater nitrate levels.
- *Wetland Reserve Program*: restores wetlands through permanent or 30-year easements or 10-year contracts. Last year about 3,000 acres of wetlands were restored, bringing the total acres in WRP to over 42,800.
- *Environmental Quality Incentives Program*: provides cost sharing for conservation practices on agricultural land. Statewide priorities include groundwater protection practices such as well decommissioning and nutrient and pesticide management and prescribed grazing. In 2005 a total of 1439 contracts for $16.4 million were signed. About 408000 acres of conservation systems were planned.

- *Well decommissioning*: proper decommissioning is essential to prevent contaminants from entering groundwater through abandoned wells, which are direct conduits to the groundwater. NRCS planned 88 well decommissionings, and completed 44.
- *Conservation Reserve Program/Conservation Reserve Enhancement Program*: participants establish permanent vegetative cover on agricultural lands in return for guaranteed rental payments.
- *Dam rehabilitation pilot projects*: From the 1950s to 1980s, through the Watershed Flood Prevention Act (PL566), NRCS built 87 small flood control dams in Wisconsin that reduced flooding and improved groundwater infiltration. Since 2000, NRCS has planned or completed the rehabilitation of 13 deteriorating dams in seven western counties as part of a four state pilot project. These accomplishments resulted in obligating of $4.5 million in federal rehabilitation funds. In an average year, these projects reduce flood damages on crops, roads, and communities by an estimated $2 million.
- *Conservation Security Program*: In 2004, Wisconsin was one of the pilot states to launch the new CSP, a program to reward good land stewardship and provide incentives to farmers to increase and enhance their conservation practices. In 2004, 212 CSP contracts were signed with farmers in the lower Chippewa and Kishwaukee watersheds. In 2005, an additional 282 CSP contracts were signed with farmers in four watersheds (the Lower Chippewa, Kishwaukee, the Duck-Pensaukee, and the Crawfish). The average payment per farm was $7,000. Good erosion control, water quality protection and improving soil quality are prerequisites for the program.

The agency also provides leadership in the following:

- *Standards Oversight Council – an Interagency Committee to revise and maintain Conservation Practice Standards*. Practice Standards benefit the public by helping to protect groundwater. For example NRCS Practice Standard Code 590 – Nutrient Management was revised in 2005. This revision enhances groundwater protection by promoting better nutrient management and minimizing agricultural nonpoint source pollution of surface and groundwater resources. Several new standards were developed in 2005 for manure storage, handling and management.

To find out more information about NRCS, go to the home page at http://www.wi.nrcs.usda.gov, contact Renae Anderson at 608-662-4422 ext. 227, or Jim Kaap at 608-662-4422 ext. 266.